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ABORTION DISEASE OF CATTLE.

PREVENTIVE MEASURES AND TREATMENT.

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IN an article on contagious abortion of cattle, published in the *Journal* for December, 1919, the writer endeavoured to present in a popular form the views which had been recently acquired concerning this disease. Since, however, the act of abortion, or "slipping the calf," represents only one phase of the complaint, it has become necessary to extend the scope of the subject and to refer to the whole as "abortion disease" in place of the narrower signification.

The term "abortion disease" includes not only infection by the abortion bacillus leading to premature birth of the fœtus, but such sequelæ as retained afterbirth, and sterility, which are frequent concomitants of the trouble. There remains a disposition on the part of farmers to attribute abortion to causes other than infection with the specific organism of this disease. Cold weather, change of feed, falls, and other injuries are blamed for having produced abortion in, say, two or three instances in a herd. In such cases the owner must be careful not to attach too much importance to outside influences. It is precisely in such circumstances that he must beware of the introduction of abortion disease. One or two cases occurring in the course

of a season may mean the commencement of a more serious visitation, and steps should accordingly be taken to ascertain whether the suspected cows are free from infection. It should be borne in mind that the symptoms of abortion are elusive. The event may take place at a very early date after conception, the only sign being that the cow which was believed to be pregnant has returned to the bull. Several authorities state that abortion takes place more commonly between the fifth and sixth months of pregnancy, but our own experience goes to show that the act frequently occurs at much longer intervals, up to the seventh and eighth months.

In these late abortions valuable information may be derived from observing the appearance of the animal both before and after the accident. In advanced stages of pregnancy the infected cow may exhibit symptoms which resemble those attending normal delivery. She appears to be "springing," and "makes a bag," while the lips of the vagina are swollen and some discharge of mucus may appear. If in milk, the secretion may be diminished and blood-tinged. The cow seems uneasy, and may be noticed to strain from time to time. Prior to the act of abortion and immediately afterwards a yellowish discharge appears. This runs down the hind parts, soiling the tail and dropping on to the paddocks or the floors of the milking-bails. The discharge becomes thinner, and then later on thicker, and greyish in colour. In these late cases retention of the afterbirth is a common event, and furnishes strong presumptive evidence of infection by the abortion bacillus.

The appearance of the aborted calf, when discovered, is also of assistance when forming an opinion, particularly in late pregnancies. The calf may be found alive, but as a rule expires shortly afterwards. It may appear to be mummified, though very seldom putrid. The discharged afterbirth appears thickened, the outer membrane being covered with a brown chocolate-coloured deposit, while the cauliflower-like tufts studded over the surface of the exterior are sometimes soft and of a yellowish colour.

As a rule, if infection be present, more than one cow in the herd aborts, and precautions should be taken immediately to deal with suspicious cases. A valuable method of diagnosis now exists in the shape of the agglutination* test. This test can be performed only in a properly equipped laboratory, but the material required—about a tablespoonful of blood from the suspected cow—is easily obtained either by a veterinarian or by the farmer himself. To secure a sample of blood, all that requires to be done is to clip away the hair on the outside of the ear, and then clean the surface with petrol or benzine rubbed on with a piece of cotton-wool. A small artery and vein run down about the middle of the ear, the artery being somewhat more deeply situated than the vein. With a sharp knife make a transverse incision across the vessels, hold the ear down, and catch the blood in a perfectly clean bottle; a 1 oz. medicine-bottle answers very well. The blood, which need not exceed a tablespoonful, should be securely packed

* Agglutination is the phenomenon which occurs when blood serum from an infected individual is added to a pure culture of the infective organism. The phenomenon takes the shape of a clumping or aggregation and subsequent sedimentation of the specific bacteria—sedimentation being the naked-eye manifestation of the agglutination.

and sent to the Veterinary Laboratory, Wallaceville, where the further processes will be carried out. Some prefer to draw the blood from an incision made under the tail, and veterinary surgeons may collect it from the jugular vein, but the latter method should not be attempted by novices.

The agglutination test indicates whether the animal is infected with the germs of abortion disease, but it does not prove that the cow will abort, only that infection is present and that precautionary measures should be taken.

PREVENTION AND TREATMENT.

It is possible to build up a herd free from abortion disease, provided the owner is willing to go to the necessary trouble and expense involved. Where the occurrence of infection is small the following measures are suggested. The herd is divided into two classes: (1) Those known to be infected; (2) those which are known to be free from the disease. This knowledge is arrived at by means of the agglutination test applied to all animals in the herd.

The two classes must be kept separate. The clean herd is periodically tested and all reactors transferred to the infected class. All animals of the infected class are brought in as soon as signs of springing are noticed. They must not be allowed to calve in the paddock. A special enclosure or loose-box should be provided wherein the cow may calve. All discharge before and immediately after the act must be washed down with disinfectant, and the afterbirth cleared away and burned. After delivery the cow must be douched with disinfectant solution, and this treatment continued daily until all signs of discharge have ceased. Service should not take place until the cow appears perfectly normal in this respect. Animals of the infected class should not be considered clean until they have failed to react to the agglutination test applied twice at intervals of six weeks. Heifer calves bred from the infected cows should be retained with the object of building up an immune herd.

In case these measures should be impracticable, individual treatment of animals which abort will have to be undertaken. The aborted calf and all membranes and discharge must be sought for and burned. The cow must be separated from the rest and receive daily irrigations with disinfectant (2-per-cent. solution of permanganate of potash). This treatment should be applied as early as possible after abortion has taken place and before the mouth of the womb has had time to close. In cases of retention of the afterbirth, the womb will remain open until the membranes have been expelled. All accumulated discharge must be washed off the tail and hind parts, and these parts sponged down with disinfectant. The remaining cows in the herd must also be carefully washed down behind in a similar manner. Cows which have aborted should not be served within two months.

To prevent the bull conveying the disease from an infected cow to another he should be treated in a similar manner. First clip away the long hair from the opening of the sheath, then with an enema syringe disinfect the penis and sheath with a 2-per-cent. warm solution of permanganate of potash. The sheath should be held partially closed with the hand to prevent the too-rapid escape of the solution. The belly and thighs should be well sponged down with 2-per-cent solution

of lysol. This process should be carried out immediately before and after service. The bull may transmit the disease mechanically by previous service of an infected cow. He may also become systemically infected and convey the disease in the seminal fluid. In order, therefore, to ascertain whether he is free from infection, blood from a suspected bull should be tested in the same manner as that from cows.

THE VACCINE TREATMENT.

Treatment of abortion disease by internal medication may be dismissed as entirely unreliable and without any scientific foundation. Preventive treatment by vaccine may offer some advantages when used among badly infected herds.

The vaccine consists of living cultures of the abortion bacillus, which are inoculated under the skin of non-pregnant animals two months before service. Opinions differ as to the actual value of vaccination as a measure of control, but fairly good results are reported from various sources. The disadvantages of the system as applied to conditions existing in this country are the necessity to make certain that the animals it is proposed to inoculate are non-pregnant, and the length of time which must elapse before service can be effected. A serious drawback, also, is the fact that, as living cultures have to be employed, the inoculated cattle are converted into "carriers" of the disease for an indefinite period. These limitations render the system unsuitable for use in clean or even only slightly infected herds, though where the disease is well established greater latitude may be permissible.

The idea that abortion may be cured or prevented by the simple process of inoculation should not be allowed to develop without a proper understanding of the nature of such treatment, and no methods of control are likely to be successful unless supported by the intelligent co-operation of the owner. The illusion which some farmers seem to cherish that something introduced with a syringe by somebody else is going to relieve them of further anxiety and trouble is, unfortunately, not at present realizable.

HERD-MANAGEMENT.

Not the least important part in the control of abortion disease is the intelligent management of the herd. Having regard to the facts that the incidence of abortion has a tendency to decline, and that immunity or tolerance becomes established in cows which have aborted, it is unwise to dispose of these animals except for slaughter. By sending them to the saleyard the disease is liable to be spread, while buying in fresh cows may mean the introduction of a susceptible animal into the infected surroundings. Calves bred in infected surroundings also acquire a tolerance for the disease. It should be the aim, therefore, of the owner of infected cows to endeavour to build up a herd of his own breeding.

Cows about to calve, either normally or when showing signs of impending abortion, should be brought into an enclosure where they can be kept under observation, and the necessary measures observed should abortion take place. Such precautions will avoid the scattering of infective material over the paddocks, which will occur if the animal be left at large. If it becomes necessary to buy in fresh stock care

should be taken to ascertain, if possible, the antecedents of the animal, and not to introduce her immediately into the herd. In such cases a blood test will determine whether she is free from infection.

Where possible a breeding-bull should be maintained, but when a loaned bull has to be used precautions should be taken and the animal treated in accordance with the advice already given.

When infected animals are isolated a suit of overalls and gum boots should be donned when going among or treating them. These must be removed, and the hands and arms washed in disinfectant, before handling healthy stock.

Unpasteurized separator milk from local factories may contain the organism of abortion, and ought not to be brought on to clean premises.

RETENTION OF THE AFTERBIRTH.

The frequency of this complication following abortion renders it necessary to offer advice regarding it. It is unwise to be in too great a hurry to remove the retained cleansing. If extraction by hand has to be resorted to it is always more difficult and less successful when attempted too early. The best course is to irrigate twice daily with warm 2-per-cent. permanganate-of-potash solution, and if the membranes are still retained not to attempt to remove them earlier than the third or fourth day. If possible, the services of a veterinarian should be obtained, for the process may not be easy, and its accomplishment may require expert knowledge of the anatomy of the parts involved. Manual extraction is a thing to avoid, if possible.

STERILITY AND "DIFFICULTY IN GETTING IN CALF."

These conditions very frequently arise as a result of infection with abortion disease, though in a few instances other factors may be responsible. The damage to the womb and appendages created by the chronic inflammatory disease set up by infection with the abortion organism assists other organisms to establish themselves in the mucous lining of the generative canal. This leads to a catarrhal condition, followed by the formation of fibrous tissue in the parts, which thereafter become partially or completely functionless.

Such conditions are difficult to treat, and the results are often disappointing. The aim must be to enable the bodily defences to overcome the invading organisms, and to this end we must provide every assistance. Chief among these measures must be the maintenance of the animal in good general health and condition by the provision of suitable food and water supply, and good well-sheltered paddock accommodation.

It is not by washing out with strong disinfectants, which further injure the delicate mucous lining of the passages, that success may be achieved, but in relieving the organs as far as possible of the accumulated inflammatory products, and stimulating the body-cells to further activity. It is too much to expect the average farmer to be able to carry out certain stages of the necessary treatment. In such cases the mouth of the womb is generally firmly closed, and before anything can be introduced into it the passage must be dilated. In dealing with these chronic inflammatory conditions of the uterus iodine has proved of great value. It is usually employed in the form of Lugol's

solution, which consists of iodine 5 parts, potassium iodide 10 parts, and boiled water 100 parts. When veterinary assistance is procurable, the solution is used to dilate the closed entrance to the womb, which in the course of two or three days can generally be made to relax sufficiently to permit the entrance of a catheter. The uterus is then flushed out with a solution of Lugol's solution, 2 parts in 100 parts of water, followed by a douche of warm salt-solution (1 oz. salt to 1 gallon water).

The object of this treatment is to stimulate and increase the blood-supply to the parts, and to diminish the vitality of the invading organisms. Where treatment of this nature cannot be carried out, recourse must be had to antiseptic injections. The vaginal passage should be washed out with warm 2-per-cent. solution of permanganate of potash a day or two before the cow is expected to come in season, and the passage may be flushed out with a solution of bicarbonate of soda (5 oz. to ½ gallon of warm water) about half an hour before service. This simple procedure has sometimes been followed by success, the cow becoming pregnant. In more advanced cases of disease of the uterus, however, veterinary aid will, as a rule, have to be obtained.

Needless to add, the age, condition, and market value of the animal should receive consideration. It is useless to waste time and material in treating an animal which could be more profitably turned into beef.

FLYING-ANTS AND POULTRY.

With reference to the case of flying-ants killing fowls, forming the subject of an inquiry published on page 248 of the last April *Journal*, Mr. W. W. Smith, Curator of the New Plymouth Botanical Gardens, sends the following note:—

"The flying-ants mentioned by your correspondent were probably both males and females of *Ponera castanea*, a well-known species of native ant. Both sexes possess stings, and use them freely if interfered with, especially during the swarming-period, which occurs annually throughout the North Island during the months of March and April. After the nuptial flight they alight on the ground, shake off their wings, and search for new and suitable sites in which to found new colonies of their race. Though common in the central areas of the North Island, they are more so in the kauri forests of the north, where they occur in large colonies under prostrate decaying logs. The larvæ, when matured, spin tough cocoons in which they pass the pupal stage, chiefly during the months of January and February. When stung in the mouth and throat the unfortunate fowls may be seen running to and fro with the mouth wide open, and finally die gasping. It is difficult to suggest any antidote or preventive, apart from the measures recommended by the Chief Poultry Instructor. Perhaps fowls kept well fed and in good condition would not feed so readily on the deadly stinging-ants."

THE INTRODUCTION INTO NEW ZEALAND OF APHELINUS MALI, A VALUABLE PARASITE OF THE WOOLLY APHIS.

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ONE of the objects of my visit to America last year was to inquire about the best method of attempting to control the woolly aphis by means of natural enemies. I had previously met Dr. L. O. Howard, Chief of the Bureau of Entomology, Washington, at the Imperial Conference of Economic Entomologists held in London the previous June. He was then on his way across from America to France with a consignment of parasites, *Aphelinus mali* Hald., and hoped to succeed in getting these chalcids established there. He has since informed me that this attempt has met with great success, the parasites having now bred out in thousands in their new home.

While I was in Washington, Dr. Howard being still away, I got into touch with Dr. Quaintance, Entomologist in Charge of the Fruit-insect Investigations, and discussed with him the possibility of introducing *Aphelinus* into New Zealand. He agreed that it should be attempted, and undertook to have consignments of parasitized woolly aphis collected in the autumn and forwarded to New Zealand via either Vancouver or San Francisco, provision being made to have them kept in cold storage while crossing the Pacific.

I reached Nelson on 11th December last. On 6th January a cablegram was received from Washington saying, "Aphids via Tofua, Wellington." This was followed later on by a letter from Dr. Quaintance, stating that the material collected had been sent across to their despatch agent, Mr. Charles Schmitz, in San Francisco, and that he had placed it in cold storage on the steamer "Tofua," which left that port on 16th December.

Meanwhile I had obtained the permission of the New Zealand Government to introduce the insects, and had also interviewed the managing director of the Union Steamship Company, Mr. C. Holdsworth, who very kindly promised to facilitate in every way the transit of this or similar consignments of beneficial insects on his company's steamers. I should like here to express my thanks to Drs. Howard and Quaintance for the trouble and interest they have taken in this matter, which I trust may prove of the greatest benefit to New Zealand; to the Department of Agriculture (in particular Mr. T. W. Kirk, late Director of the Horticulture Division), and the Minister of Internal Affairs, for the permission to import the insects; and to Mr. Holdsworth, for his help in facilitating their transit across the Pacific.

The "Tofua" arrived in Wellington on 11th January. The parcel of parasitized material was taken out of cold storage there, and reached Nelson on 13th January. In the meantime, preparations had been made at the Cawthron Institute for receiving it. Mr. Philpott, the Assistant

Entomologist, had been artificially infesting with woolly aphis the young apple-trees planted out in the grounds the previous winter, and some good growing colonies were ready against the day when the parasites should begin to breed out. I had designed a special breeding-cage for them, which had been satisfactorily made by a Nelson firm, and into which the parasitized material was put the moment it was opened up. A photograph of this cage is shown in Fig. 1. It is a rectangular box, the inside measurements being 24 in. long by 15 in. wide by 6 in. deep, closed by two lids, the inner being a sliding one covered with fine wire gauze, the outer one hinged and made of solid wood. When the outer lid is lifted up, as shown in the figure, the contents can be examined through the gauze, without any danger of even the smallest insect escaping. When the outer lid is closed the inside of the cage is in darkness. Along the front of the cage there is a row of eleven circular holes, into each of which a cork is tightly fitted, carrying a small test-tube, whose open end thus projects slightly into the interior of the cage. The cage being placed with the outer closed ends of the row of test-tubes pointing to the light, it follows that, to any insect emerging within the cage, the cage will appear dark except for the eleven areas of light represented by the mouths of the test-tubes. Consequently, each insect, on emergence, will make for one or other of these areas of light, and will thus make its appearance in one or other of the test-tubes, which can then be removed and stopped up with cotton-wool, a fresh test-tube being substituted in its place.

The consignment consisted of six separate boxes of apple-twigs, two from Washington State, two from Connecticut, and two from Arkansas. I had specially asked Dr. Quaintance to obtain material from widely separated localities, in order that we might introduce at the very start a good, healthy, mixed strain of the parasite, and avoid all possibility of inbreeding by the introduction of material from one locality only. The three localities from which the material was gathered are about as wide apart as possible, considering the distribution of the parasite, and hence it was reasonable to hope that a good mixed strain would result. No attempt was made to keep the material from the six boxes separate, but all was placed together inside the cage, which was at once closed down.

It is well known that most chalcid parasites of injurious insects are themselves parasitized in turn by other species of chalcids, known as "secondary parasites" or "hyperparasites." The good work which a beneficial parasite like *Aphelinus mali* may be able to accomplish in a new locality like New Zealand might be very greatly, perhaps almost wholly, nullified if any of these secondary parasites were inadvertently allowed to be liberated with it. In order to avoid all possibility of this I decided that nothing which could not definitely be determined as *Aphelinus mali* should be placed out on the infected apple-trees; in other words, all other chalcids which might appear in the test-tubes, whether they were definitely known to be secondary parasites or not, should be destroyed. The importance of this decision will be realized when the composition of the emerging brood which we obtained is carefully examined.

There was sufficient material in the consignment from which to breed hundreds of chalcids, and we were very hopeful that we might

obtain a good supply. This hope was not fulfilled. The first chalcids emerged on 25th January, one being an *Aphelinus mali*, and one a very similar but slightly smaller insect. Both these were killed and mounted for study. The smaller insect proved to belong to some other genus, similar to *Pachyneuron*, and so was probably a secondary parasite. On 26th January two more of these insects emerged, and both were killed. On 28th January another small chalcid emerged, together with a larger, bright metallic-blue *Aphidius*, both of which were also killed and mounted. On 1st February a minute lepidopteron appeared in one of the tubes. This was also killed and mounted. It is just possible that it may belong to a species whose larva is an aphis-feeder,

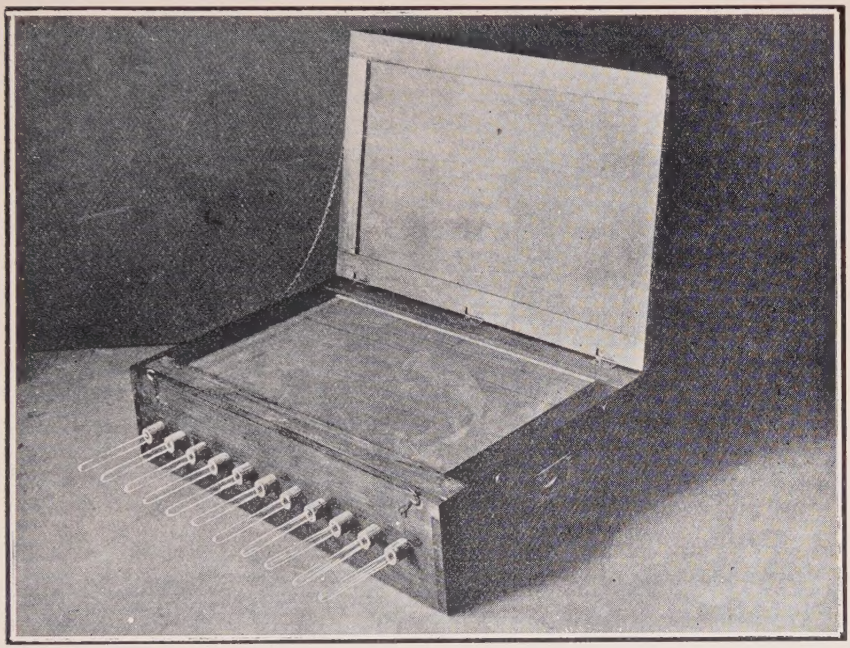


FIG. 1. SPECIAL CAGE USED FOR THE BREEDING OF APHELINUS MALI.

Showing the outer lid open and the inner wire-gauze lid closed.

[*W. C. Davies, photo.*

or it may have been a chance introduction on one of the apple-twigs. From 2nd to 6th February, during a period of fairly warm weather, chalcids were obtained in the tubes every day, as follows: 2nd February, one *Aphelinus;* 3rd, four *Aphelinus;* 4th, three *Aphelinus;* 5th, two *Aphelinus* and two other chalcids (both killed); 6th, two *Aphelinus* and three other chalcids (killed). On 7th February a second specimen of the tiny lepidopteron appeared; this was killed and mounted. On 9th February a single *Aphelinus* bred out, another on 13th, another on 15th, and one more each on 18th and 19th. Nothing further appeared until 26th February, when a well-grown psocid larva crawled

out into one of the tubes. Nothing more has since been obtained from the cage, which has remained closed right through the summer.*

Table I shows the above records in tabular form, together with the mean daily temperature and the rainfall during the period of emergence :—

I. TABLE SHOWING INSECTS BRED FROM THE CONSIGNMENT OF PARASITIZED APPLE-TWIGS RECEIVED FROM AMERICA.

Date.	Mean Temp. (in Deg. Fahr.).	Rainfall (in Inches).	*Aphelinus mali.*	Other Chalcids.	Other Insects.
Jan. 24	60·5	..	..	..	..
25	60·5	0·38	1	1	..
26	62·0	..	..	2	..
27	58·7	0·27	..	..	..
28	62·2	..	..	2	..
29	63·2	..	..	..	..
30	54·5	..	..	..	..
31	55·2	0·04	..	..	..
Feb. 1	57·5	0·02	..	..	L.
2	59·0	..	1	..	..
3	60·2	..	4	..	..
4	59·0	..	3	..	..
5	60·0	..	2	2	..
6	64·5	0·04	2	3	..
7	63·5	1·29	..	..	L.
8	64·5	..	..	..	..
9	65·0	..	1	..	..
10	64·2	..	..	..	..
11	65·2	..	..	..	..
12	61·5	..	..	..	..
13	57·0	..	1	..	..
14	63·5	..	..	..	..
15	62·0	..	1	..	..
16	61·2	..	..	..	..
17	64·5	0·11	..	..	..
18	64·5	..	1	..	..
19	62·5	..	1	..	..
26	59·5	..	..	..	Ps.
Totals	..	2·15	18	10	3

NOTE.—In last column L. indicates lepidopteron, Ps. psocid.

HISTORY OF THE SPECIMENS OF APHELINUS MALI BRED OUT FROM THE AMERICAN MATERIAL.

As already stated, the first specimen of *A. mali*, bred out on 25th January, was killed and mounted for study. It was carefully compared with the other chalcids bred out, so that suitable characters

* Since the above was written I have received a letter from Mr. Swezey, Honolulu, telling me that the small moth bred out from the parasitized material has been sent to Washington and determined by Mr. Busck as *Nepticula pomivorella* Packard. It is a leaf-miner on apples, and has no connection with the woolly aphis except common food plant. Its minute cocoon is fastened anywhere on the trunk or branches of apple-trees, and was evidently present in the material. The chalcids are being studied by Mr. Timberlake, of Honolulu, and their names will be available later. Both he and Dr. Quaintance, of Washington, state that none of them are secondary parasites of *Aphelinus*.

might be found by which *A. mali* might be distinguished with certainty from any of the others merely by using a hand-lens. The characters found of most value for this purpose were the general build of the insect, the colour of the antennæ (dark basally and yellowish distally), the shape and length of the antennæ, and the presence of a yellowish band around the base of the abdomen. The second specimen, bred out on 2nd February, was also killed and mounted, and these characters again carefully studied. Both these specimens were males.

Meanwhile Mr. Duncan, one of the trustees of the Cawthron Institute, had offered us the use of a Cox's Orange apple-tree in his garden, which had a good deal more woolly aphis on it than the small trees in the Institute grounds. This offer was thankfully taken advantage of, to the extent that seven specimens out of the nine which emerged during the period 3rd to 5th February, inclusive, were taken and placed out on this tree. Little more than a week later Mr. Duncan reported that the woolly aphis was fast disappearing. On examination shortly afterwards the tree was found to be practically free from woolly aphis, and there was also no sign of the *Aphelinus*. The tree was kept under observation from time to time, but nothing further was seen of the parasites placed out on it. It is probable that the woolly aphis was cleared from the tree by wax-eyes (*Zosterops lateralis tasmanica*), so that the *Aphelinus* were unable to get a fair start.

The other two of the nine specimens mentioned above perished in the tubes, and were mounted for study. These also were males.

Five specimens emerged during the period 6th to 15th February, inclusive. Three of these were males and two females. They were all placed out on tree No. 5 in the Institute grounds. This tree was one of twelve planted out in two rows last winter for the purpose of work on the control of woolly aphis. These trees are placed 8 ft. apart in the rows, the two rows being 12 ft. apart. The odd-numbered trees are in one row, the even numbers in the other, according to the following arrangement :—

First Row.	Kind.	Second Row.	Kind.
No. 1	.. Cox's Orange.	No. 2	.. Cox's Orange.
No. 3	.. Cox's Orange.	No. 4	.. Cox's Orange.
No. 5	.. Statesman.	No. 6	.. Cox's Orange.
No. 7	.. Statesman.	No. 8	.. Statesman.
No. 9	.. Sturmer.	No. 10	.. Sturmer.
No. 11	.. Sturmer.	No. 12	.. Rokewood.

The distances and the plan of arrangement of the trees are given, as they are of some interest in considering the natural spread of the second brood of *Aphelinus*, an account of which is given below.

Finally, the last two specimens of *A. mali*, bred out on 18th and 19th February respectively, were taken to Mr. Duncan's garden, and liberated on a branch of the same tree as before, where a small amount of woolly aphis was still to be seen.

All the specimens placed out in Mr. Duncan's garden failed to produce any offspring, and nothing more has been seen of them at any time. The history of the introduction of *Aphelinus mali* into New Zealand, therefore, now resolves itself into the story of what happened to the three males and two females placed out on tree No. 5.

A long period now intervened during which none of the five insects placed out were to be seen, and there was no sign of the appearance of any offspring. It was not until the beginning of April that Mr. Philpott, who had kept most careful watch on tree No. 5 every day of the preceding six weeks, brought in two aphids which were evidently parasitized, being black and swollen, without any flocculent white material adhering to them. From these we bred out one specimen of *Aphelinus mali* on 2nd April, and another on 4th April. Both of these died, and were mounted. The following day, 5th April, we made our first recovery of the new brood from tree No. 5, no less than seven specimens being found on the stems and leaves of this tree.

HISTORY OF THE FIRST NEW ZEALAND BROOD OF APHELINUS MALI, BRED FROM THREE MALES AND TWO FEMALES PLACED OUT ON TREE NO. 5.

Recoveries of specimens which were the progeny of the five original individuals, placed out on tree No. 5 in February, continued to be made on most days throughout April, the last specimen being taken on 3rd May. At first the tree was searched morning and afternoon, but it was soon discovered that specimens were not obtained after 2 p.m., and searches were then made only twice or thrice in the forenoon. The specimens were at first placed alive in test-tubes, being supplied with a little honeydew for food. They fed readily enough on this, and would keep alive, on an average, about three days. At first mostly males appeared, but towards the end females greatly predominated. The plan adopted was to collect usually the total for two consecutive days, and to take them out in test-tubes to a selected orchard, where they were liberated on a specially selected tree in the presence of the orchardist, who was then asked to keep a watch on them, and to keep this particular tree from being sprayed until the succeeding brood had become well established. Owing to the difficulty of getting the insects to come out of the test-tubes, we soon used a slightly different plan, which consisted of substituting for the test-tube a piece of glass tubing about 5 in. long, plugged up with cotton-wool at each end (Fig. 2). The insects were carried about in these tubes, and were liberated with considerable ease merely by inserting a twig or pencil in one end and pushing the wad of cotton-wool up until it was brought within a short distance of the wad at the other end. Thus all the *Aphelinus* became imprisoned in a small space at one end of the tube. The other wad was then removed, and the tube held in such a position as to touch the surface of an apple-leaf situated not far from a good patch of woolly aphis. The *Aphelinus* would then mostly crawl out on to the leaf, and any that refused to move could soon be induced to leave by continuing to push the remaining wad until it reached the end of the tube; any *Aphelinus* clinging to it were by this means brought outside. Care needs to be taken in this work, as the insects are quite easily startled, and are inclined to skip off suddenly and fall to the ground.

In most cases the operation of getting the *Aphelinus* on to the leaf was performed successfully. Once on the leaf the insects would soon begin to explore, and quickly found their way to any patches of woolly aphis near-by. On a number of occasions pairing took place

either in the tube or immediately after the insects reached the leaf. On several occasions the insects were seen at work amongst the aphids even as late as three days after being placed out. We feel, therefore, justified in claiming that *Aphelinus mali* has been now successfully introduced into New Zealand.

The first seven specimens taken from tree No. 5 were placed out on tree No. 2, a Cox's Orange with a fair amount of woolly aphis on it. Six more were placed out on this same tree on 8th April. On 1st May we recorded the first recovery of *Aphelinus* from this tree; this specimen was probably the first of the progeny of the insects placed out nearly a month before.

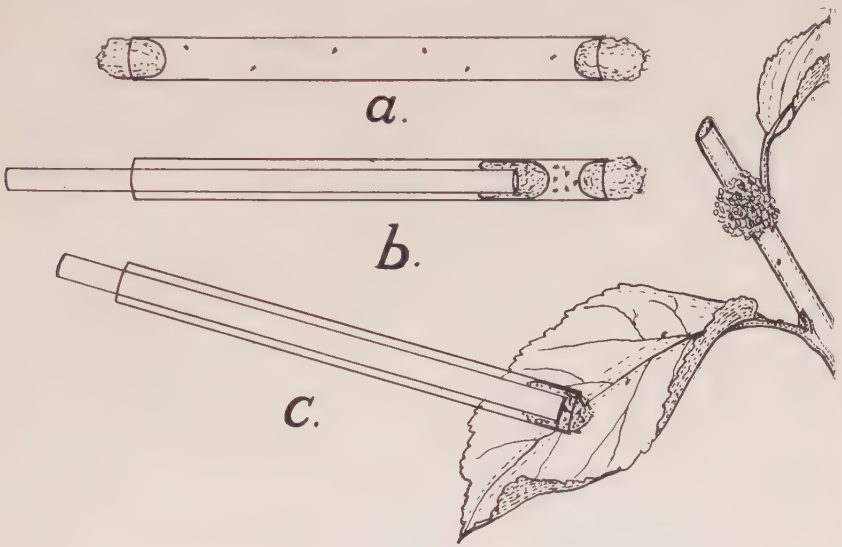


FIG. 2. DIAGRAMS SHOWING THE METHOD OF USING GLASS TUBES FOR THE PLACING-OUT OF LIVING APHELINUS ON INFESTED APPLE-TREES.

a, Glass tube with its two ends closed by plugs of cotton-wool, and containing six *Aphelinus*; *b*, pushing up one plug by means of a twig or pencil, so as to bring the parasites all into one small space at one end of tube; *c*, placing the parasites out on an apple-leaf, by removing the end plug and pushing the second plug right to the end.

The other trees in the two rows were examined from time to time. Most of them had little or no woolly aphis on them, but one, No. 12, had a considerable amount. This tree must have become naturally infected with *Aphelinus* from tree No. 5, for, from 24th to 29th April, inclusive, seven specimens were recovered from it. These must either have been strays from tree No. 5, or, less probably, the progeny of eggs laid by one of the two original females on tree No. 12.

At the beginning of May very cold weather set in, and the emergence of *Aphelinus* was brought to a stop. Thus, at the end of the summer, we find the first New Zealand brood completed, consisting of no less than *one hundred and forty-two specimens*, the progeny of the

three males and two females originally placed out on tree No. 5, and not including others which we must undoubtedly have missed in our examinations of the trees.

The details of the recovery of this brood from tree No. 5, and what was done with them, are best given in the form of a table, as follows :—

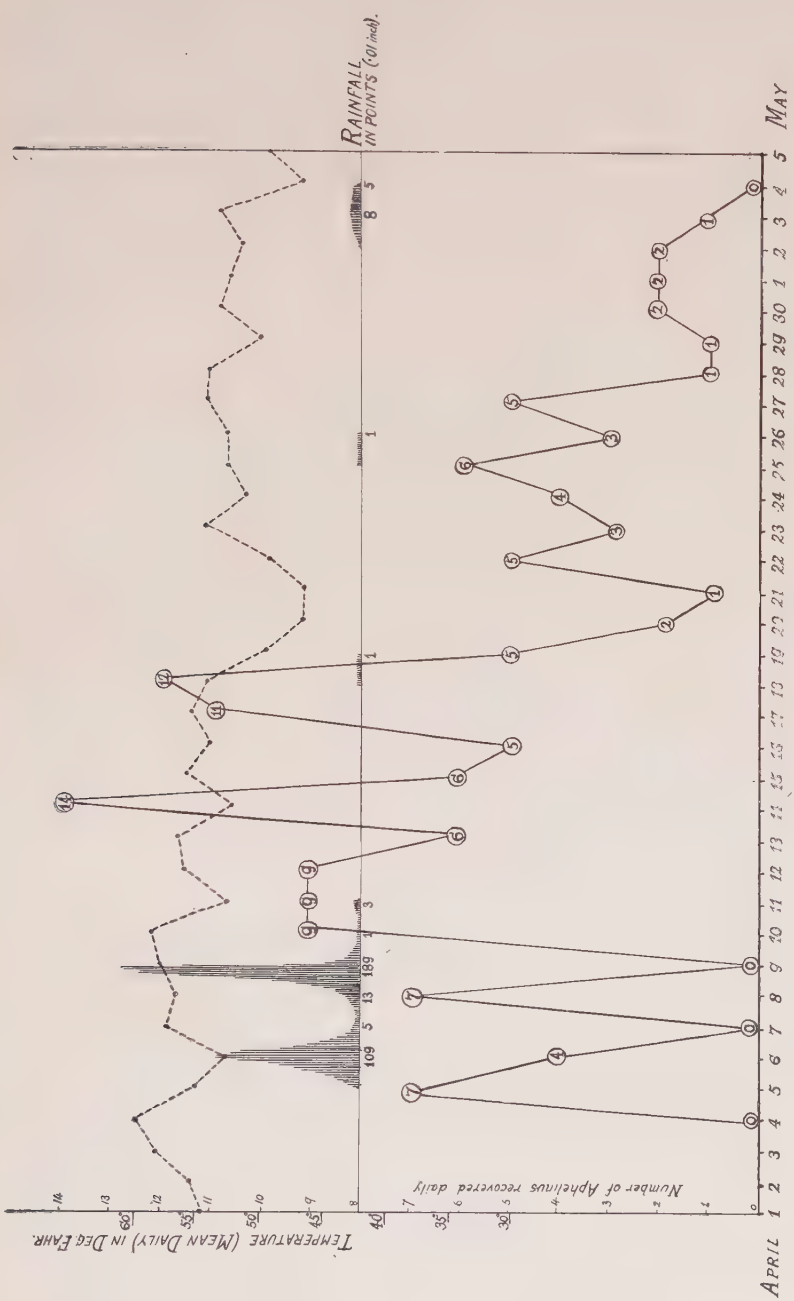
II. TABLE SHOWING THE DATES AND NUMBERS OF EMERGENCE OF THE FIRST NEW ZEALAND BROOD OF APHELINUS MALI, AND THE LOCALITIES IN WHICH THEY HAVE BEEN PLACED OUT.

Date.	Number recovered.	Number placed out.	Where placed out.		
			Locality.	Orchard.	Tree.
April 5 ..	7	7	Nelson ..	Cawthron Institute	Tree No. 2.
6 ..	4	..	..	..	..
7 ..	..	4	Nelson ..	Mr. Duncan's ..	Cox's Orange.
8 ..	7	6	Nelson ..	Mr. Duncan's ..	Cox's Orange.
9 ..	..	..	..	..	..
10 ..	9	6	Nelson ..	Cawthron Institute	Tree No. 2.
11 ..	9	12	Stoke ..	Mr. Gilbert's ..	Delicious.
12 ..	9	..	..	..	..
13 ..	6	15	Stoke ..	Annesbrook ..	Sturmer.
14 ..	14	..	..	..	..
15 ..	6	19	Stoke ..	Mr. Child's ..	Munroe.
16 ..	5	..	..	..	..
17 ..	11	15	Nelson ..	Mr. Harley's ..	Sturmer.
18 ..	12	..	..	..	..
19 ..	5	14	Stoke ..	Mr. Dagger's ..	Allington.
20 ..	2	..	..	..	..
21 ..	1	..	..	..	..
22 ..	5	..	..	..	..
23 ..	3	8	Tasman ..	Miss Hunter-Brown's	Sturmer.
24 ..	4	..	..	..	..
25 ..	6	..	..	..	..
26 ..	3	7	Stoke ..	Mr. Pickup's ..	Munroe.
27 ..	5	..	..	..	..
28 ..	1	(6)	(Exhibited alive at Nelson Apple Show.)		
29 ..	1	..	..	..	..
30 ..	2	5	Nelson ..	Mr. Gibb's ..	Old tree, unnamed.
May 1 ..	2	2	Nelson ..	Mr. Harley's ..	Sturmer.
2 ..	2	4	Tasman ..	Miss Hunter-Brown's	Sturmer.
3 ..	1	3	Redwood's Valley	Colonel Collins's ..	Sturmer.
Totals ..	142	127			

NOTES.—Included in the "Number recovered" in the above table are the following numbers taken from trees other than tree No. 5: From tree No. 12—24th April, one; 25th, four; 26th, one; 29th, one. From tree No. 2—1st May, one.

The difference between the number recovered and the number placed out is accounted for by ten which died in the tubes and five at the apple show.

On the opposite page there is shown in the form of a graph the number of emergences of *Aphelinus mali* in the first New Zealand brood, together with the mean daily temperatures (in degrees Fahrenheit) and the rainfall, the former being shown by the broken line, the latter by means of shaded areas. This graph shows very clearly the effect of the weather on the emergence of the parasite.



GRAPH TO SHOW THE DAILY NUMBER OF EMERGENCES OF APHELINUS MALI OF THE FIRST NEW ZEALAND BROOD, CORRELATED WITH MEAN DAILY TEMPERATURE (BROKEN LINE) IN DEGREES FAHRENHEIT, AND WITH RAINFALL (SHADED AREAS) IN HUNDREDTHS OF AN INCH.

The rise in temperature to a maximum height on 4th April led to the first extensive emergence, seven being obtained the following day. Two days later a drop in temperature, with heavy rain, stopped the insects from emerging, but they were again active the following day, which was warm and sunny. Another burst of heavy rain again stopped them down for twenty-four hours on 9th April. From that date to 18th April the days remained warm and sunny, the mean temperature oscillating between 52° and 57°. It was during this period that the majority of the brood emerged, the total being eighty-one for the nine days, an average of nine per diem. From 18th to 21st April there set in a much colder period, with very little rain, but a great deal of cloud. The mean temperature dropped eight degrees in two days. As a consequence, the number of emergences per diem decreased rapidly from twelve to five, then to two, and then to one only. With the rise in temperature from 22nd April onwards, and with unclouded sunshine for most of the time, the daily numbers again increased, twenty-four more specimens emerging in the six days 22nd to 27th April inclusive, or an average of four a day. Cloudy and showery weather set in on 2nd May, with a considerable fall in temperature the following day; and this seems to have put an end to the series of emergences.

Thus it will be seen that the emergence of this brood extended over twenty-nine days, and was notably affected by rain and cloud, and more especially by sudden drops in the temperature. Males predominated at the beginning and females at the end of the brood.

It will be seen by reference to Table II that the 127 individuals placed out alive from the first New Zealand brood have been distributed over a considerable area of country. Forty-five specimens have been put out on four trees in four separate orchards in Nelson. Sixty-seven specimens have been placed out on five trees in five separate orchards in Stoke, the positions of these orchards ranging from Annesbrook, about three miles from Nelson, to Mr. Child's, on the Richmond boundary, nearly eight miles from Nelson. Twelve specimens have been placed on one tree at Tasman, about twenty-eight miles from Nelson, on the western side of Tasman Bay. Finally, three specimens were put out on a tree in Redwood's Valley, about fourteen miles from Nelson, or halfway to Tasman. It may be confidently expected that the majority of these new colonies will yield progeny in the spring, from which the further stage of more intensive spreading of the parasite throughout the Nelson Province may then be attempted.

With regard to the number of broods that may be looked for in such a climate as that of Nelson, it is, of course, impossible to say definitely how many there will be next summer. We are unable at present to tell when the first spring brood is likely to appear. Assuming that this will happen about September, there would apparently be time for four or more broods to be produced during the summer. The parasite having no enemies in New Zealand, such a rate of increase ought to produce sufficient individuals to stock the whole of the Nelson Province within the next year, and the whole of New Zealand by the end of the following year, provided the winter mortality is not too heavy, and method of distribution to distant points is developed satisfactorily.

SHORT ACCOUNT OF THE LIFE-HISTORY OF APHELINUS MALI.

The perfect insect has a very short life, the males living only three or four days, the females about five or six. The females are active all the time, except only in very dull, wet weather. They search about for clumps of woolly aphis, feeding on the honeydew, and attacking the individual aphids by piercing them with their fine hair-like ovipositors. Only one egg is laid within the body of each aphis. This act of the *Aphelinus* causes considerable discomfort to the aphis, which frequently wriggles its body and extrudes a minute amount of fluid from the wound. This fluid must not be confused with the honeydew, which is almost always present, in much larger spherical globules.

Within the body of the aphis the egg of *Aphelinus* soon hatches into a minute legless larva or grub, which proceeds to devour the internal organs of its host. There is just sufficient nourishment within

FIG. 3. ADULT MALE APHELINUS MALI, GREATLY ENLARGED (ACTUAL SIZE $\frac{1}{25}$ IN. LONG).

a, Stigmal club, much more enlarged.

[*From Bulletin 110 of United States Bureau of Entomology.*

the body of the aphis to enable this grub to become full-fed. It then ceases to feed, and sets about converting the empty skin of its host into a hard, black, swollen case, within which it later on changes to a pupa. After a short period of rest the imago or perfect insect forms within the pupal shell, throws off the light pupal covering, and cuts its way out of the shell of the aphis by means of its mandibles.

Fig. 4 shows a cluster of woolly aphis which has been attacked by *Aphelinus*. Most of the parasites have already emerged from the smaller group to the right, and the large circular holes left by the escaping adults can clearly been seen in the shells of the aphis. Fig. 5 shows this group of aphis enlarged.

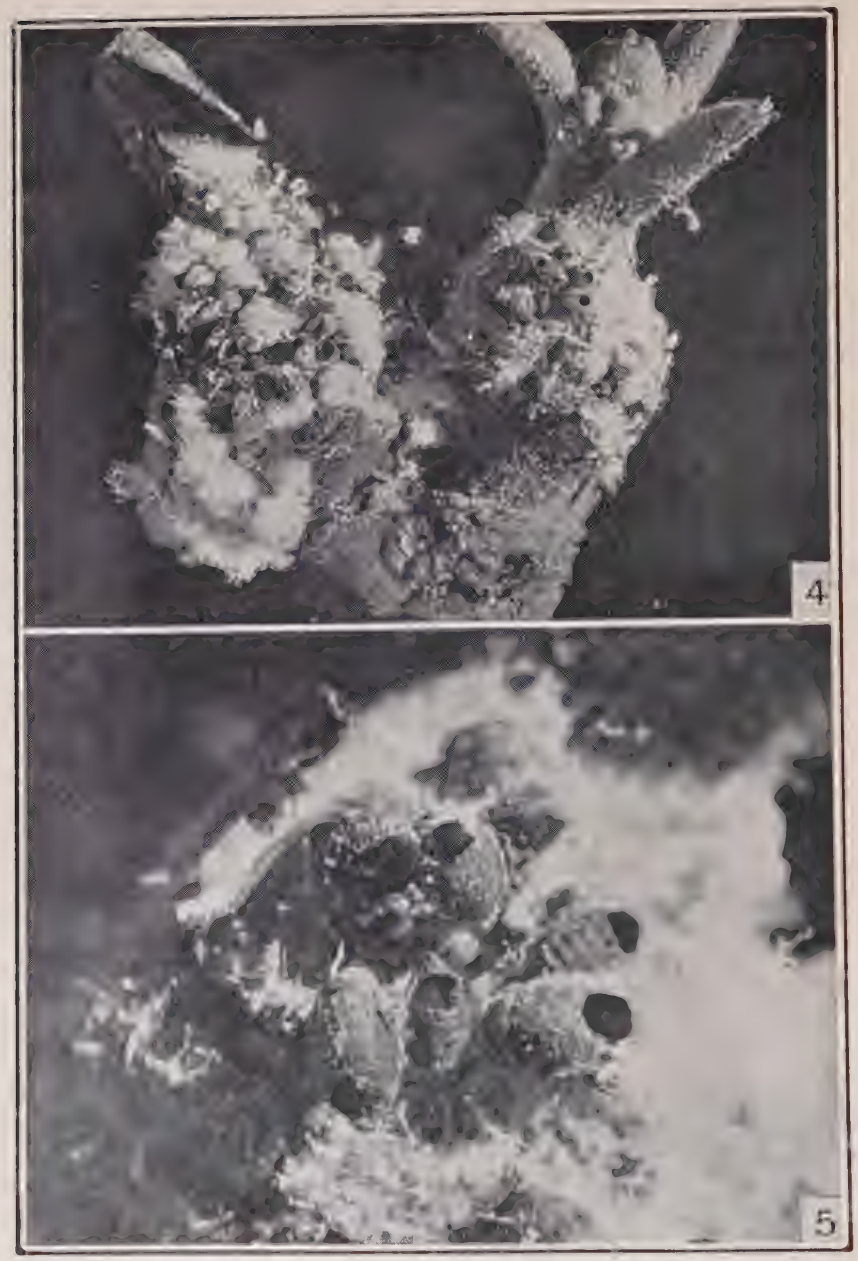


FIG. 4. TWO CLUSTERS OF WOOLLY APHIS PARASITIZED BY APHELINUS MALI, × 4.

The larger cluster on left only partially parasitized; the smaller on right completely destroyed by the parasites, and with most of them emerged.

FIG. 5. THE RIGHT-HAND CLUSTER OF WOOLLY APHIS IN FIG. 4 SHOWN ENLARGED, × 10.

Notice the large round holes made by the parasites when emerging. An *Aphelinus* in the smallish aphis in the lower centre of the picture emerged suddenly just before the photo was taken, owing to the great heat of the electric light upon it.

[*W. C. Davies, photo.*

The signs of successful parasitism of woolly aphis by *Aphelinus* are (1) the discomfort and wriggling of the individual aphids, and the exuding of minute amounts of fluid from the wounds; (2) the gradual loss of the white woolly covering; (3) the migration of individual aphids away from the main clusters to odd positions on the leaves or stem, where they perish, becoming fixed, swollen, black objects; (4) the swollen and black appearance of groups of parasitized aphids in the main clusters; and (5) the later appearance of the exit-holes by which the parasites have escaped. Besides these, a careful inspection on any warm summer day will be sure to reveal the adult individuals of *Aphelinus* exploring the surface of the leaves and twigs, and also attacking colonies of the aphis.

Fig. 3 shows a male *Aphelinus mali*, greatly enlarged. The male is about 1 millimetre ($\frac{1}{25}$ in.) long, the female somewhat larger and stouter. When at rest the wings are folded straight down the back, so that the insect has much the appearance of an extremely minute bee. The general colour is black, but the distal half of the antenna is pale-yellowish, and there is a band of yellowish round the base of the abdomen.

In conclusion, I wish to place on record my appreciation of the help which I have received in this work from Mr. Alfred Philpott, Assistant Entomologist at the Cawthron Institute. He has undertaken the greater part of the work of observation of the parasites during the summer, and has greatly helped in the collecting and distribution of the individuals of the first New Zealand brood. Success could not have been obtained without his devoted and painstaking work. I also wish to thank Mr. W. C. Davies, Curator of the Cawthron Institute, for the excellent photographs reproduced in Figs. 1, 4, and 5, and Mr. H. Harrison, the Curator's Assistant, for supplying the requisite meteorological data used in this paper. Fig. 3 was reproduced from an excellent figure given on page 122 of Bulletin 110 of the United States Bureau of Entomology, and is acknowledged with thanks.

Phormium Tenax and South Africa.—An officer of the South African Union Department of Agriculture, who recently visited St. Helena, has returned much impressed with the success obtained there by cultivation and milling of *Phormium tenax*, which is reported as having been a highly remunerative enterprise for the island. Writing in the *Journal* of his Department he expresses his conviction that the same success awaits its cultivation in the Union in those parts where climatic and economic conditions are suitable, particularly throughout the whole coastal area, assuming, of course, that milling-facilities are provided. It may be mentioned that the development of the New Zealand flax industry at St. Helena was effected about thirteen years ago, with the assistance of the New Zealand Department of Agriculture, whose Chief Fibre Expert at that time (Mr. C. J Fulton) visited the island at the request of the Imperial Government. Phormium was introduced into St. Helena by whalers many years ago.

IMPROVEMENT OF POOR PASTURE.

THE WALLACEVILLE EXPERIMENTS.

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

IN this *Journal* for January, 1919, and October, 1920, were given the results of the experiments carried out at the Wallaceville Laboratory Farm to determine the improvement in feeding-quality it was possible to effect by top-dressing poor unploughable pasture, following beech ("birch") forest, with limestone and various phosphates. These experiments have been continued, and the figures are now available to January, 1921. The results are of very great interest in view of the fact that one of the phosphates applied in August, 1915, is practically identical in chemical composition with the Nauru Island phosphate, which is becoming readily available to the New Zealand farmer. It is anticipated, however, that the Nauru phosphate will be in a much finer state of division than that employed in these experiments, and therefore a given quantity of the Nauru phosphate will be more efficacious than the latter.

SEASON 1919.

In the 1919 season's experiments the sheep were weighed and placed on the plots on 16th May, and thereafter weighed every fortnight to determine the increase in weight. The experiments, as heretofore, were under the supervision of Mr. J. Evans, Farm Overseer, who was solely responsible for the amount of stocking to which the paddocks were from time to time subjected. As in previous years, stray dogs, by worrying the sheep, gave some trouble until they were shot.

Fortnightly weighings for the 1919 season's grazing are given in the accompanying Table III. The weighings of each sheep have been recorded, but for the purpose of this article it is considered adequate to publish the averages for each group.

The average live-weight increase per sheep and other gains on each experimental paddock for the whole season are summarized as follows:—

Table I.

Paddock No.	Top-dressing.	Days' Grazing for Six Extra Cattle.	Increase per Sheep.	Extra Sheep.	Plus Wool clipped per Sheep.
			lb.	lb. per Sheep.	lb.
1	Basic slag, applied February, 1919	34	60·2	2·7	8·3
2	Control—nil	Nil	37·0	Nil	7·4
3	Rough limestone and Island phosphate, applied August, 1915	15	56·2	3·0	8·5
4	Rough limestone, applied ditto	6	50·0	1·7	8·0
5	Egyptian basic phosphate, applied ditto	5	53·6	5·3	8·0

Only the paddocks numbered 2, 3, and 4 are strictly comparable, as the slag paddock was recently dressed, and the Egyptian phosphate paddock is in a more sheltered position on the farm.

On the control paddock (No. 2) the sheep all commenced to lose weight in June, and the majority had not recovered their lost weight until October. The control paddock was so closely grazed that it was not necessary to put on any extra sheep or cattle during the flush of growth in December.

On the slagged paddock (No. 1), as on all, the loss in weight commenced at the same time, but the recovery was much quicker on No. 1 than on the control, being complete by 4th September. In addition to the ten permanent sheep on this paddock it was found necessary to add three extra ewes from 12th December, and six cattle from 23rd November until the end of the grazing (thirty-four days).

On paddock 3 (limestone and phosphate) the recovery was a little slower, being not complete until 19th September, when all but one sheep had made up the loss. Six cattle and three extra ewes were placed in this paddock on 8th November. The cattle were removed on 23rd November (fifteen days), the sheep remaining.

On paddock 4 (limestone alone) the results are closely similar to those of paddock 3. The sheep had regained the loss in weight by 19th September. Six cattle were placed on this paddock on 2nd November and removed on 8th November (six days). Three additional ewes were added on 12th December.

On paddock 5 (Egyptian phosphate) similarly the losses were made up by September. Six cattle were grazed on this paddock from 28th October until 2nd November (five days). Three ewes were placed on the paddock on 12th December.

The three extra ewes on each paddock were weighed on 12th and 27th December, the total weights and increases being as follows: Paddock 1, 391 lb., 399 lb.; gain, 8 lb. Paddock 3, 426 lb., 435 lb.; gain, 9 lb. Paddock 4, 453 lb., 458 lb.; gain, 5 lb. Paddock 5, 416 lb., 432 lb.; gain, 16 lb. The extra ewes were in all cases continued until the end of the season's grazing.

SEASON 1920.

In the 1920 season the sheep were placed on the experimental paddocks later than usual (8th June). The usual loss in weight occurred on the control paddock in August and September, but this loss was recovered by 12th October. A slight loss also occurred on paddock 4 (rough limestone), but this was speedily made up again. There were no losses on the other paddocks.

The average live-weight increase per sheep and other gains for the season's experiments were as follows:—

Table II.

Paddock No.	Top-dressing.	Days' Grazing for Three Cattle.	Increase per Sheep.	Plus Wool clipped per Sheep.
			lb.	lb.
1	Basic slag	46	61·8	9·6
2	Control—nil	Nil	30·6	8·7
3	Limestone and Island phosphate ..	17	57·2	9·7
4	Limestone	6	54·9	9·4
5	Egyptian basic phosphate ..	15	47·7	9·3

TABLE III. FORTNIGHTLY AVERAGE WEIGHINGS (IN POUNDS) FOR 1919 SEASON.

Ten Sheep (in each Paddock).	May 16.	May 31.	June 13.	June 28.	July 11.	July 26.	Aug. 9.	Aug. 28.	Sept. 4.	Sept. 19.	Oct. 3.	Oct. 17.	Oct. 31.	Nov. 14.	Nov. 28.	*Dec. 12.	Dec. 27.
Paddock 1. Basic Slag, applied February, 1919.																	
Total weight ..	779	881	905	929	909	912	915	901	957	1019	1078	1120	1183	1271	1323	1343	1388
Average weight ..	77·9	88·1	90·5	92·9	90·9	91·2	91·5	90·1	95·7	101·9	107·8	112·0	118·3	127·1	132·3	134·3	138·8
Gain (G) or loss (L) ..	..	G13·0	G2·7	G2·6	L2·1	G0·3	G0·3	L1·5	G6·2	G6·4	G5·8	G3·9	G5·6	G7·4	G4·9	G1·5	G2·8
per cent. on total																	
Paddock 2. Control (no Fertilizer or Lime).																	
Total weight ..	795½	922	930	903	893	875	850	845	863	902	926	963	1023	1052	1140	1157	1165
Average weight ..	79·5	92·2	93·0	90·3	89·3	87·5	85·0	84·5	86·3	90·2	92·6	96·3	102·3	105·2	114·0	115·7	116·5
Gain (G) or loss (L) ..	..	G15·9	G0·9	L2·9	L1·1	L2·0	L2·8	L0·6	G2·1	G4·5	G2·6	G4·0	G6·2	G2·8	G7·7	G1·5	G0·7
per cent. on total																	
Paddock 3. Rough Limestone and Island Phosphate, applied August, 1915.																	
Total weight ..	797½	911	939	934	912	904	880	887	926	984	1036	1101	1187	1254	1295	1339	1359
Average weight ..	79·7	91·1	93·9	93·4	91·2	90·4	88·0	88·7	92·6	98·4	103·6	110·1	118·7	125·4	129·5	133·9	135·9
Gain (G) or loss (L) ..	..	G14·2	G3·0	L0·5	L2·3	L0·8	L2·6	L0·8	G4·4	G6·2	G5·3	G6·3	G7·8	G5·6	G3·2	G3·4	G1·5
per cent. on total																	
Paddock 4. Rough Limestone, applied August, 1915.																	
Total weight ..	783½	892	929	915	897	879	850	844	896	937	985	1035	1135	1169	1220	1258	1283
Average weight ..	78·3	89·2	92·9	91·5	89·7	87·9	85·0	84·4	89·6	93·7	98·5	103·5	113·5	116·9	122·0	125·8	128·3
Gain (G) or loss (L) ..	..	G13·9	G4·1	L1·5	L1·9	L2·0	L3·3	L0·7	G6·1	G4·5	G5·1	G5·0	G9·6	G3·0	G4·3	G3·1	G2·0
per cent. on total																	
Paddock 5. Egyptian Basic Phosphate, applied November, 1915.																	
Total weight ..	796	915	941	911	893	888	882	898	957	1016	1039	1092	1137	1225	1275	1299	1332
Average weight ..	79·6	91·5	94·1	91·1	89·3	88·8	88·2	89·8	95·7	101·6	103·9	109·2	113·7	122·5	127·5	129·9	133·2
Gain (G) or loss (L) ..	..	G14·9	G2·8	L3·1	L1·9	L0·5	L0·6	G1·8	G6·6	G6·1	G2·3	G5·1	G4·1	G7·7	G4·0	G1·9	G2·5
per cent. on total																	

* All sheep were shorn on 29th November.

Notes on Weather, Stocking, &c., for Fortnight preceding each Weighing.—Fortnight to 16th May: Nil. 31st May. Frosty and cold, with rain. 13th June: Frosty, with fine days; second week very mild; very little rain. Dogs troublesome on paddock 4. 28th June: Cold, wet, and very windy. 11th July: First week fair, with cold rains occasionally; second week frosty nights and fine days. 26th July: Fair to cold, with plenty of rain. 9th August: Cold and wet. 22nd August: Cold and wet; latterly a little warmer, but wet. Sheep in paddock 1 annoyed by dogs; one sheep worried. 4th September: Good, warm, growing weather, with very few frosts. 19th September: Fair, with plenty of rain. 3rd October: Fair, with rain and equinoctial gales. 17th October: Weather warm, with fair amount of rain. 31st October: Hot and dry, with little rain; one sheep on paddock 5 scouring, and another standing about. 14th November: Warm and moist; good growing weather. 28th November: Two sheep worried slightly by dogs during part of this period. 12th December: Six cattle placed on paddock 1 on 23rd November and not yet removed. Three extra ewes, weighing 135 lb., 128 lb., and 128 lb., were also added on 12th December. Paddock 2 did not receive extra sheep, nor were cattle grazed there. Six cattle placed on paddock 3 on 8th November, and removed 23rd November. Three ewes, weighing 161 lb., 135 lb., and 130 lb., were also added on 12th December. Six cattle placed on paddock 4 on 2nd November, and removed 8th November. Three ewes, weighing 135 lb., 154 lb., and 164 lb., placed on 12th December. Six cattle placed on paddock 5 on 28th October, and removed 2nd November. Three ewes, weighing 146 lb., 146 lb., and 124 lb., placed on 12th December. 27th December: The cattle (6) were still on paddock 1. In paddock 1 a sheep had to be killed after accidentally breaking a leg.—(*Supplied by Farm Overseer.*)

TABLE IV. FORTNIGHTLY AVERAGE WEIGHINGS (IN POUNDS) FOR 1920 SEASON.

Nine Sheep (in each Paddock).	June 8.	June 28.	July 13.	July 27.	Aug. 10.	Aug. 24.	Sept. 7.	Sept. 25.	Oct. 12.	Oct. 30.	*Nov. 23.	Dec. 8.	Dec. 21.	†Jan. 4.	†Jan. 19.
Paddock 1. Basic Slag.															
Total weight	693	710	732	866	886	926	945	997	1059	1147	1157	1186	1206	1336	1336
Average weight	86·6	88·8	91·5	96·2	98·4	102·8	105·0	110·7	117·6	127·4	128·5	131·7	134·0	148·4	148·4
Gain (G) or loss (L) per cent. on total	..	G2·5	G3·1	G6·4	G2·3	G4·9	G2·1	G5·5	G6·2	G8·2	G0·8	G2·5	G1·7	G6·2	..
Paddock 2. Control (no dressings).															
Total weight	693	729	716	808	815	811	807	836	844	923	930	973	1008	1056	1055
Average weight	86·6	91·1	89·5	89·7	90·5	90·1	89·6	92·8	93·7	102·5	103·3	108·1	112	117·3	117·2
Gain (G) or loss (L) per cent. on total	..	G5·2	G1·8	G0·4	G0·9	L0·5	L0·5	G3·6	G1·0	G9·3	G0·8	G4·6	G3·6	G4·8	..
Paddock 3. Rough Limestone and Island Phosphate.															
Total weight	693	745	755	877	891	908	933	981	1034	1121	1136	1176	1215	1268	1295
Average weight	86·6	93·1	94·4	97·4	99·0	100·8	103·6	109	113·8	124·5	126·2	130·6	135	140·8	143·8
Gain (G) or loss (L) per cent. on total	..	G7·5	G1·3	G3·1	G1·6	G1·9	G2·8	G5·1	G5·4	G8·4	G1·3	G3·5	G3·3	G4·3	G2·1
Paddock 4. Rough Limestone.															
Total weight	693	728	733	865	859	857	877	913	961	1055	1081	1143	1182	1236	1274
Average weight	86·6	91·0	91·6	96·1	95·4	95·2	97·4	101·4	106·7	117·2	120·1	127	131·3	137·3	141·5
Gain (G) or loss (L) per cent. on total	..	G5·1	G0·7	G2·1	L0·7	L0·2	G2·3	G4·1	G5·2	G9·8	G2·4	G5·7	G3·4	G4·6	G3·1
Paddock 5. Egyptian Basic Phosphate.															
Total weight	693	742	761	895	922	929	963	1004	1056	1120	1123	1128	1150	1206	1209
Average weight	86·6	92·8	95·1	99·3	102·4	103·2	107·0	111·5	117·3	124·4	113·6	114·2	127·7	134	134·3
Gain (G) or loss (L) per cent. on total	..	G7·1	G2·6	G5·5	G3·0	G0·8	G3·7	G4·3	G5·2	G6·1	G0·3	G0·5	G1·9	G4·9	G0·2

*All sheep were shorn on 16th November. † 1921.

Notes on Weather, Stocking, &c., for Fortnight preceding each Weighing. — 8th June: Heavy rains during most of period. 28th June: Heavy rains during most of period. 3th July: In paddock 4 a sheep was slightly affected with blindness, but was recovering. 27th July: Nil. 11th August: Nil. 24th August: Nil. 7th September: The Railway Department having taken a strip of paddock 1, the sheep have since 1st instant been grazing on less pasture than usual. 25th September: Wet during latter end of period, but fairly warm. 12th October: First week showery; last week warm and dry. 30th October: First week was warm and dry; since then heavy rains fell each day. Three 18-months cattle put on paddock 5 on 27th October. 23rd November: Heavy rains daily during period. Sheep shorn on 16th November. On 6th November cattle shifted from paddock 5 to paddock 4, and on 12th to paddock 3. 8th December: Damp, but very warm. On 1st December a sheep in paddock 3 had to be destroyed owing to a large abdominal swelling, and another sheep of the same weight was put on and given the same number. Cattle shifted to paddock 5 on 29th November, and on 4th December to paddock 1, where they remained to the end of the experiment. 21st December: Fine during period, and latterly very warm. In paddock 5 a sheep lost 8 lb. in weight, though there did not appear to be anything wrong with the animal. 4th January: Dry and very warm. In paddock 1 a sheep was removed owing to its falling off in condition. In paddock 5 another sheep was removed similarly. 19th January: Warm and dry.—(*Supplied by Farm Overseer.*)

For some unexplainable cause the sheep on paddock 5 lost condition towards the end of the (1920) season, possibly through attacks of dogs. Detailed average weighings for the several paddocks are given in Table IV.

In considering these returns it must not be forgotten that the slagged paddock (No. 1) was top-dressed as recently as February, 1919, and the high results may be due to the fact that the carrying-capacity of paddocks 3 and 4, which have not been artificially top-dressed since August, 1915, compares very favourably with the slagged plot.

METEOROLOGICAL RECORDS.

The following records (supplied by courtesy of the Director of the Weather Bureau, Mr. D. C. Bates) from observing-stations nearest to the Wallaceville Farm are of interest as bearing on the action of the various top-dressings and the weight-increases of the sheep:—

Table V.

—	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Rainfall and Rainy Days at Whiteman's Valley, Silverstream.													
1919.													
Inches ..	4·06	1·48	2·03	1·26	..	..	..	..	..	..	..	..	..
Days ..	9	3	5	6	..	..	..	..	..	..	..	..	..
1920.													
Inches ..	6·38	3·98	3·07	7·63	6·28	5·96	1·44	6·83	6·63	5·05	4·94	3·05	61·24
Days ..	15	9	7	15	15	14	9	19	15	13	12	4	147
1921.													
Inches ..	3·20	0·88	..	..	..	..	..	..	..	..	..	..	..
Days ..	8	1	..	..	..	..	..	..	..	..	..	..	..
Rainfall and Rainy Days at Western Hutt.													
1919.													
Inches ..	6·77	1·70	2·17	1·00	1·85	3·11	3·68	3·51	2·97	3·04	2·78	2·46	35·04
Days ..	12	2	6	7	7	16	19	13	13	8	11	10	124
1920.													
Inches ..	6·52	4·76	2·69	9·10	2·30	6·16	1·72	5·31	4·81	..	..	..	..
Days ..	14	8	6	16	13	12	11	22	14	..	..	..	..

NOTE.—No records were taken where columns are blank.

Sheep Maggot-flies.—The magnification of the greenbottle (*Lucilia sericata*) shown in Fig. 15 of the article on sheep maggot-flies in last month's *Journal* is 7 diameters. Owing to a type flaw the figure "7" did not print out on the press in the final machining.

New Zealand Butter in Jersey.—A recently received copy of the Jersey Island *Evening Post* does not support the general view that our butter is never retailed in the United Kingdom under its own name. A stores advertisement announces in bold type: "New Zealand butter —splendid quality—just arrived." The fact of the penetration of New Zealand butter into the home of the Jersey cow is another point of interest.

COMMERCIAL POTATO-GROWING.

GUIDANCE FOR NEW ZEALAND CONDITIONS.

H. E. McGOWAN, Willowbridge, South Canterbury.*

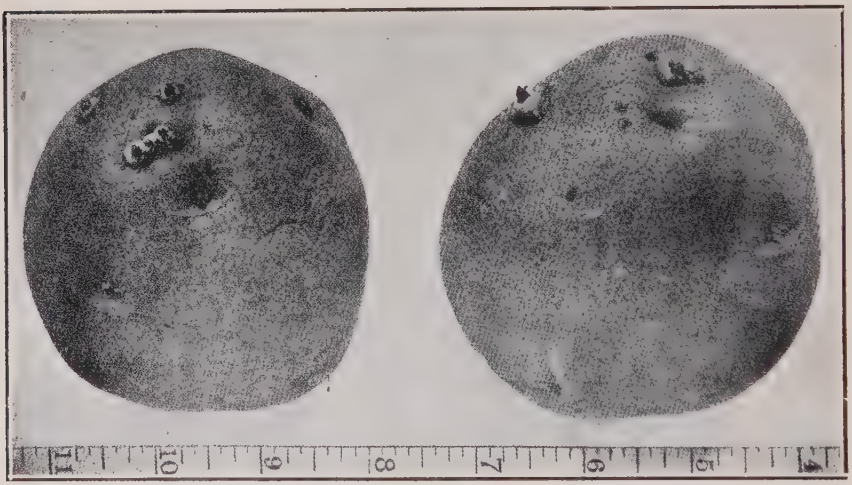
THE above title readily explains the nature of a series of articles which it has been arranged I shall contribute to the *Journal*. My purpose is to deal mainly with potato-growing in the field for market, and with standard varieties, as distinguished from the smaller or garden culture. I do not intend to deal with the history of the potato, raising plants from seed, propagation, breeding of new varieties, and so forth. There are several excellent books treating fully of these branches of the subject. It will be understood that these notes are not being written for experienced growers, but mainly for the benefit of new settlers—returned soldiers and others—numbers of whom have recently taken up cropping land with very little knowledge of the work. Should any points not be quite clear, or dealt with fully enough for individual readers, I shall be pleased to answer inquiries by correspondence.

THE SEED.

Selection.—Selection of the seed is perhaps the most essential factor in successful potato-growing, and yet many growers are most careless in this respect. In saving seed the best roots or hills should be selected. In every crop of potatoes there is a great deal of difference, as regards both quality and quantity, between the tubers from different roots or hills. When selecting the seed attention should be given to the following points: Firstly, only those tubers grown from a root which throws true to type should be taken; secondly, all tubers from selected roots should be well shaped and shallow-eyed; thirdly, selection should be made only from roots which give a considerable number of large tubers. By selecting in this manner the crop will be kept true to type of well-shaped shallow-eyed tubers, and also tend to increase in yield. I am aware that this procedure means tedious work, but it well repays the grower. By following this method many 4- or 5-tons-per-acre crops can be worked up into 10- or 12-ton yields. It should be realized that 75 per cent. of the small potatoes in a crop are small because they are starved through some disease, such as black-stem, leaf-curl, &c., and the seed of the disease is still in those tubers ready to carry on as soon as the new plant commences to grow. The farmer selects his best lambs for breeding-ewes, his best calves for his milking-herd, and so on; then why should he not grow his potatoes on the same lines? "Like begets like" in potatoes just as, generally speaking, it does in any animal or seed.

*Mr. McGowan is well known as one of our leading practical potato-growers, while he has also carried out much experimental work in potato-culture. He took a prominent part in the recent organization of the South Island Potato-growers' Association, and is chairman of the central council of that body.—EDITOR.

Change of Seed.—A change from time to time is a very important matter. I have seen a crop on the same field, having received exactly the same cultivation, with one part yielding 15 tons per acre and the remainder giving 8 tons. The first part of the field had been planted with seed obtained from a colder-natured soil, and the latter with seed which had been grown on the farm for four years. They were both the same variety (Maori Chief), and the result was 7 tons per acre in favour of the change of seed. The crop was sold at £5 per ton, and as there were 20 acres in the field (8 planted with the imported seed and 12 with the old seed) the lesser return represented £420 lost—undoubtedly beneficial experience, but dearly bought. In this case the change of seed came from a distance of ten miles only, but the land in that district is of a cold ironstone nature, while the soil where the crop referred to was grown is a heavy sandy ideal potato-land.



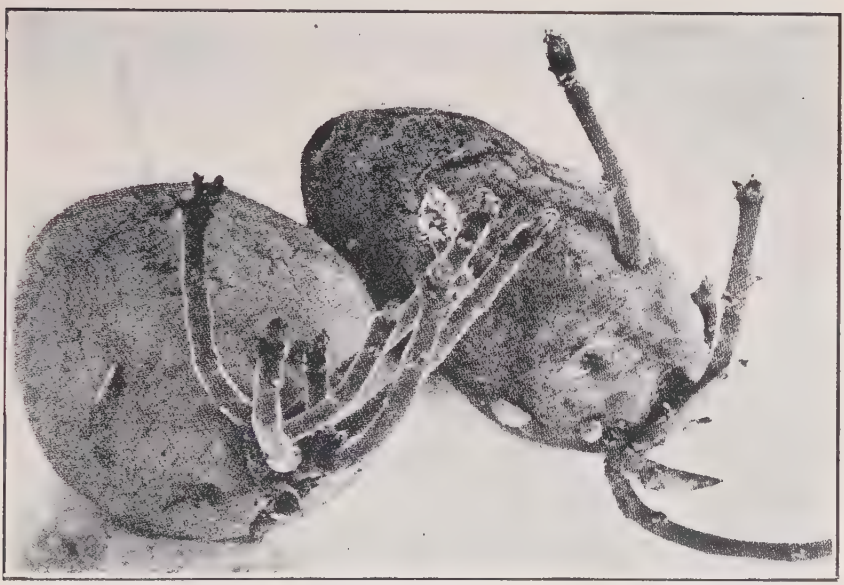
A GOOD TYPE AND QUALITY OF TABLE POTATO FOR THE MARKET.

Such cases should convince growers of the necessity of getting a change of seed at least every three years. If a change gives only 1 ton per acre extra (to say nothing of 7 or 8 tons) it is a paying proposition. One not only gets the increased yield, but also a much better sample, the tubers being larger and more even. The haulms are also more "growthy," and this keeps down the weeds by smothering.

Size of Sets.—For my own planting I prefer seed about the size of a small hen-egg, weighing about 1½ oz. A great deal really depends upon the quality of the soil. If the soil is fairly rich small seed is preferable, but if it is poor, and especially light, I would advise planting large seed. The reasons are that in the richer soil there is ample humus and moisture to foster the young growing plant, but with the poorer and drier soil the large sets or seed in rotting after sprouting supply both moisture and a certain amount of humus to the plant. Some prefer nice shapely seed, and it undoubtedly has a better appearance;

SPROUTING OF SEED-POTATOES

THE RIGHT WAY.

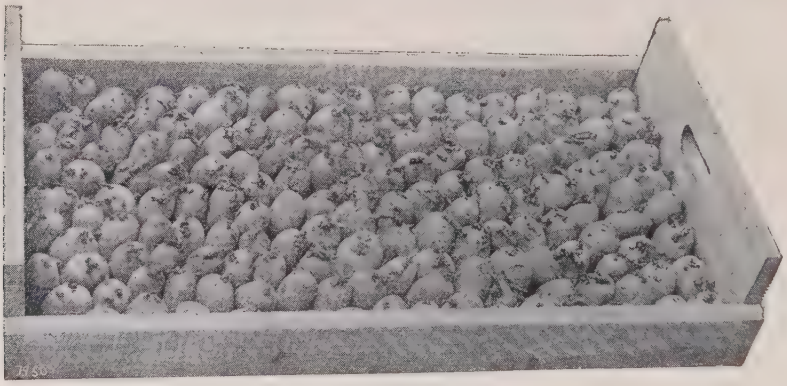


THE WRONG WAY.

[*From United States Bulletin 127.*

but if growers would try immature seed—no matter how unshapely—they would possibly be astonished at the result both in yield and quality. The immature seed has more vitality and vigour, and is usually less affected with disease. Again, a matured potato has a hard, dry, netted skin, while the immature one is usually thin-skinned and smooth.

Whole or Cut Seed.—There is much diversity of opinion on this matter. At Willowbridge we all plant with the potato-planter, and the whole-seed feeds surer than the cut. With cut sets, moreover, there is always a possibility of a number rotting before sprouting, and as a large grower does not care to risk this, round seed is always used. By cutting large shapely table potatoes one will undoubtedly get a crop of well-shaped potatoes, also there is not so much probability of the potatoes "running out." In regard to running out, it should be understood that through careless selection, and continuously planting small seed, the yield, quality, and type gradually decrease. Again, one can discard all sets showing signs of blackleg or black-stem blight,



SPROUTING-TRAY

Ends 3 in. deeper than sides, thus allowing air-space between boxes when piled. Ventilation also secured by leaving ½ in. space between bottom-boards. Box holds about 25 lb. of seed.

whereas with the whole sets this is impossible. When using cut sets only use those from the rose end of the tuber; it is there the stronger eyes are found.

Storage and Sprouting.—For the early market I certainly advise sprouting the seed. Lay the seed in shallow trays or boxes six or eight weeks before it is intended to plant, and then place the boxes in a sunny airy shed or shelter. By planting-time short, thick, strong sprouts will be formed. Great care should be taken when planting not to break or damage these sprouts in any way. Discard any tubers showing weakly sprouts.

It is impracticable to sprout seed for the main crop—by which is meant the 5-, 10-, or 20-acre field—in fact, in sorting or keeping seed for that purpose the necessity must be borne in mind of preventing it from sprouting. Seed sprouted in bulk—that is, in sacks or pit—

loses much of its vitality, the sprouts being always thin, weak, and useless. I would suggest storing in sacks, but these should not be placed one on another. Keep them in a sunny place and turn them over frequently.

SELECTION AND PREPARATION OF THE GROUND.

The best ground available should always be selected for the potato crop; potatoes like a rich loamy or sandy soil. A good rotation is following the breaking-up of an old grass or clover paddock, or after beans or peas.

In the case of a grass or clover paddock skim-plough in January or February, which will give the sod time to rot. About a month before planting-time cross-plough as deeply as possible—up to 9 in. if it can be done. Leave this up to the frost and just before planting run through the ground with a grubber or cultivator to break the furrows. Follow this with a double stroke of the harrows, and the plot should be ready for planting. I do not believe in having the soil too fine, but where there is a lot of old grass-sod it is difficult to make it too fine.

If the potatoes are following beans or peas skim-plough as soon as those crops are harvested. This will allow the beans or peas lying about the surface to sprout and act as a green manure; after which follow with deep ploughing, &c., as already described.

Where there is neither old pasture nor beans or peas to follow, and it is necessary to plant potatoes after a straw crop, the following suggestions are offered: Skim-plough as soon after harvesting as possible, then grub well and harrow so that seeds of all kinds may germinate. If it is early enough to grow a green crop for ploughing in, by all means do so—say, horse-beans or peas. These germinate and make a fine green manure. If twitch or yarrow is present in the stubble land work it well out before sowing the green crop, otherwise it will cause a lot of trouble among the potato crop. It is much easier cleaning the ground before the potatoes are planted, when one can get the cultivator and harrows to work, than after the potatoes are up and the work has to be done by hand.

(To be continued.)

Governor-General at Ruakura.—At the time of the Waikato Winter Show Lord and Lady Jellicoe paid a visit to the Ruakura Farm of Instruction, where they were shown the various points of interest and the live-stock by the manager (Mr. A. W. Green), and later visited the returned soldiers' quarters. Their Excellencies each planted a commemorative tree in the homestead avenue. They were later entertained at luncheon at the homestead by Mr. and Mrs. Green.

Bobs Wheat.—For several years Bobs wheat has succeeded at the Ruakura Farm of Instruction when other varieties have failed—chiefly through rust-attack—and the past season's experience has given further proof of its suitability for that locality. The crop (spring-sown) yielded 35 bushels per acre.

FIREBLIGHT AND ITS CONTROL.

THE HAWTHORN QUESTION.

A. H. COCKAYNE, Biologist to the Department.

[Paper read at the New Zealand Fruitgrowers' Federation Conference, Wellington, June, 1921.]

FIREBLIGHT is a plant-disease caused by a specific organism belonging to the bacteria and known as *Bacillus amylovorus* (Burr) Trev. It is of interest that fireblight was the first recognized bacterial disease of plants. In the late "seventies" the actual causative organism was cultured and postulated. Prior to that many human and animal diseases had been shown to be due to bacteria, but the discovery that fireblight was of bacterial origin marked the commencement of any real knowledge concerning bacterial diseases in plants. Although the actual cause of fireblight was not known until almost 1880, it had been recognized as a serious disease of pip-fruit trees for almost a century before that date. The disease is of American origin, and was first recorded in New York State in 1790. From that date it gradually spread throughout the United States and Canada, but did not reach California until 1900, where within eight years it destroyed two-thirds of the pear-orchards of that State.

Fireblight was first found in New Zealand in the latter part of 1919, and certainly at that time had not been long established in the country. During the summer of 1919–20 a very careful survey was made of all New Zealand orchards and the then distribution of the disease was ascertained. It was found to be confined to the North Auckland and Auckland Land Districts, its southernmost point being in the vicinity of Kihikihi and its northern point Warkworth, about 130 miles apart. The disease, however, was not general over this area; there were many more or less definite infection centres, such as at Tauranga, Opotiki, Te Aroha, the lower Waikato, around Auckland City, Silverdale, and Warkworth. The largest area generally infected in 1920 was the Waikato district, where it was very common on hawthorn, and pear and apple trees. The widely separated points of infection located in the summer of 1919–20 certainly indicate that the disease had been distributed by means of diseased nursery stock, but definite information regarding this point has not been satisfactorily secured.

During the present season the distribution of the disease has become more general in the Auckland District, south of Auckland City, but in all cases the spread has been simply an extension and coalescing of the infection centres located last year, and no new districts have been involved. In the vicinity of Auckland the disease has extended considerably, and threatens the extensive orchards in the Waitemata County. In the Waikato the disease is now general, but has not passed south of Kihikihi, while the Thames orchards are still free. In the Tauranga district it has also spread considerably both along the coast and inland.

At the time when the first outbreak was discovered it was found that the ordinary hawthorn, so largely used in the Auckland Province

for hedges, became badly infected, and it was at once recognized that if the plant were capable of carrying over the disease during the winter the problem of eradication would be extremely difficult. A cablegram was sent to the Bureau of Plant Industry, Washington, to ascertain whether in America the disease was capable of wintering over in hawthorn, but the reply was quite non-committal except saying that hawthorn was liable to infection. Our laboratory work carried out in the winter of 1920, however, showed that in New Zealand the disease winters over in hawthorn, so that the hope that it might not act in this way was not realized. It has now been shown that districts where hawthorn is abundant become more rapidly and more generally infected than where that plant is not prevalent, and the present position is that wherever hawthorn is present in an infected district no control of the disease in orchards can be satisfactorily carried out until the hawthorn is completely eliminated.

During 1920 a great amount of work was done in infected districts in the cutting-out of affected branches of fruit-trees, and also in the removal and burning of badly infected trees. In all areas where hawthorn was abundant and infected the value of such work can be ranked as nil, owing to rapid reinfection of the orchards from diseased hawthorn in their vicinity. In certain instances, notably at Warkworth and Silverdale, the disease has apparently been stamped out, but in these cases the hawthorn factor was not present.

ELIMINATION OF HAWTHORN.

From the experience of the past two seasons it seems clear that had it not been for the presence of infected hawthorn the efforts of the Department in the suppression of the disease would have been successful. It is therefore necessary to impress upon all orchardists the definite fact that the disease cannot be controlled, much less eradicated, so long as the menace from the hawthorn remains. It amounts to this, that in order to control fireblight effectively the hawthorn must go. Whether or not it will be necessary to eradicate hawthorn from the whole of New Zealand in order to cope successfully and permanently with the disease is perhaps a matter of opinion. For my part, I am confident that for all practical purposes the disease can be put on a controllable basis by the eradication of hawthorn in all important fruitgrowing districts. In districts where fruitgrowing is unimportant I can see no necessity for dealing with the hawthorn at all. If this policy were followed—namely, hawthorn-eradication in certain definite orcharding centres in New Zealand—it would mean that any extension of pip-fruit growing would have to be limited to such districts. It would appear to be reasonable, as an immediate step towards future control, that every effort should be made to keep the disease within its present limits sufficiently long to enable the eradication of hawthorn from the majority, if not all, the important orcharding centres to be carried out. For this purpose I am strongly in favour of the creation of protective belts both north and south of the present limits of infection. In these belts, which should not be less than five miles wide, all host-plants of the disease should be entirely removed. It is not to be expected that such belts would be permanently successful in keeping the disease within its present limits, but they might keep it from spreading to important

orcharding areas sufficiently long to enable the removal of hawthorn to be carried out in such areas before infection reaches them. Provided hawthorn is absent, fireblight infection of orchard centres, although serious enough, could be successfully dealt with by the rigid adoption of the American system of control, but so long as hawthorn remains in such centres no practical method of control could be applied once infection had appeared.

It may be said that the removal of hawthorn from areas not yet infected, and making no attempt to eliminate that plant from the present infected districts, is rather a stupid suggestion, but an examination of the facts shows such not to be the case. It has to be clearly understood that any immediate and complete eradication of the disease from New Zealand is practically impossible, therefore the object should be to get the disease on a sufficiently controllable basis to bring any further damage caused by it to the lowest possible point. This I claim can be done by the elimination of hawthorn from all our important orcharding centres. In the Waikato alone, where the disease is now rampant, there are some thousands of miles of hawthorn hedges the majority of which are infected. Their elimination would cost hundreds of thousands of pounds, probably far more than would the elimination of hawthorn from all our main orchard districts. So far as orchard interests are concerned, those of the Waikato are so small as to render any great expenditure in eradicating hawthorn there a non-economic proposition. In America it is only in certain States, notably California, Oregon, and Washington, that any systematic control of fireblight is attempted; in all other States of the Union no concerted action is taken. Arguing from the experience in America where control is not attempted, and also from our two years' local experience, one can forecast with a fair degree of accuracy what would be the result to our orchard interests were the disease left uncontrolled in New Zealand. Pear-growing would have to be entirely abandoned. Many of our standard varieties of apples would become so seriously affected that they would have to be replaced by others less subject to the disease. The establishment of new apple-orchards would become precarious, as also would be the raising of pip-fruit nursery stock. Finally, the ever-present menace that most of the apple crop might be lost in certain seasons through blossom-infection would render any extension of the pip-fruit industry unlikely.

Provided fireblight can be successfully controlled, the prospects for the development of pip-fruit growing into one of our major industries seem assured. The experience of western America has shown that efficient control can be practically carried out and losses reduced to almost a negligible point provided the disease is confined to fruit-trees, and without doubt similar methods are applicable here in any fruit district if hawthorn is absent. The elimination of hawthorn only from important orchard districts, and rigid adoption of the American method of control as soon as any infection reaches them, appears to be the only reasonable attitude to adopt.

HOST-PLANTS.

I now wish to touch upon the various plants that are affected with fireblight. Fireblight affects only certain members of the rose family, and for all practical purposes may be said to be confined to the genera

Pyrus and *Crataegus*. To the former belong apples, pears, quinces, medlars, and mountain-ashes, and to the latter all the hawthorns. In addition, another genus *Amelanchier* (juneberry), is regularly infected in America. It has been said that this plant does not occur in New Zealand, but this is incorrect, as it is grown in gardens and regularly listed by nurserymen. Very occasionally in America the genus *Prunus* becomes infected, and there are records of apricot, cherry, and plum having been attacked, but such are so unusual as to be of no moment to the fruitgrower. It has also been suggested that roses and blackberries would carry the disease, but there is no evidence to show that such is the case.

In New Zealand fireblight has been identified in my laboratory on apple, pear, quince, hawthorn, and medlar. The last-named plant had not previously been known as a host of fireblight until its presence on the plant was postulated by Mr. R. Waters, of my staff. So far fireblight has not been found in New Zealand on mountain-ash, nor on any but the ordinary species of hawthorn, nor on japonica (*Pyrus japonica*), so largely grown in gardens, but all these plants are likely to carry the disease. No attack on any stone-fruit has been as yet recorded here. I particularly warn orchardists that japonica is likely to carry the disease, and in any creation of protective belts this fact must be taken into consideration.

In New Zealand pear-trees have suffered more than any others. This coincides with American experience, where in many districts pear-growing has had to be abandoned; but apple-growing, especially of certain varieties, can nevertheless be successfully followed, even where control measures are not generally adopted. Again, on young vigorously growing trees both of pears and apples the disease spreads with much greater rapidity than on older trees. So far Keiffer's Hybrid pear has not become infected, but I do not place much importance on this fact, as in America it was also reported to be fireblight-proof, a contention that has not been sustained. With regard to apples, so far no varieties appear to be immune, but certain varieties, such as Five Crown, are more seriously affected than others; again, certain varieties do not appear to carry the disease through the winter, but one season's experience on these points is unlikely to be in any way conclusive.

SHORT LIFE-HISTORY OF FIREBLIGHT.

Owing to the fact that the fireblight infects plants in different ways, many names have been applied to the disease, most of them referring to some special type of infection. Thus, for instance, the disease is in America known as blossom-blight, twig-blight, collar-blight, &c., these all being names for the one disease caused by the one causal agency, the fireblight bacillus.

The disease is carried through the winter in the tissues, mainly towards the edge of the lesions (wounds) that were produced the previous season. In the spring the bacilli in these lesions multiply enormously, and drops of exudate containing myriads of the organism exude on the surface of the lesions. This exudate is carried by insects on to the flowers, and blossom-infection takes place. The blossoms wither and die, and the disease passes into the fruit-spur, killing the tissues, and may further develop, forming large wounds on the limbs and killing

the branches, or it may not progress further than the fruit-spur. Once flowers are infected honey-bees may spread the disease to every flower in an orchard within a few days. After flower-infection has ceased, shoot-infection (or "twig-blight," as it is termed) sets in, and may continue throughout the summer and autumn. Shoot-infection is caused by the conveyance of exudate, which may be present either on the old or freshly developed lesions, by insects of various kinds. Infection immediately occurs provided any of the exudate is placed on a wound on the shoot; and all shoots provide an abundance of such wounds, especially if either sucking or biting insects are present. Shoot-infection frequently rapidly spreads to the larger limbs, and entire branches may be quickly killed and the formation of large lesions occur, such lesions carrying over the disease for another season.

We thus have two important factors in the spread of the disease: Firstly, the presence of wounds in which the bacilli winter over, known as hold-over cankers; and, secondly, the presence of insects as transmitting agents of the ooze from lesions, causing fresh infections. The total elimination of either of these factors would eliminate fireblight. It is manifestly impossible to eliminate all the insects capable of transmitting fireblight even if it were advisable, as, for instance, in the case of the honey-bee; so that it is clear that every effort should be made to eliminate the other factor—namely, the presence of hold-over cankers. Now one is back at the hawthorn point again. What is the use of eliminating hold-over cankers from fruit-trees when there are likely to be myriads of them on every hawthorn hedge in the vicinity of the orchard? In order to eliminate hold-over cankers—the first essential in control—the hawthorn will have to be destroyed root and branch from every important fruitgrowing district in New Zealand.

RESEARCH ON CONTROL FACTORS.

The recognition of the difficulties ahead of securing the total destruction of hawthorn in New Zealand naturally makes one anxious to find out whether some other method of control than that elaborated in the United States could not be devised. The prospect is not at all hopeful. Here is a disease on the control of which an immense amount of work has been carried out in the United States for the past half-century, and no better method than the cutting-out of all diseased wood has been found. Spraying experiments have been found to be useless, and the method of injections of different materials into the tree itself has been suggested by Dr. R. J. Tillyard, of the Cawthron Institute. He is carrying out certain work along this line, and the Department is also carrying out work in the same direction. For my part, I do not think that the prospects along this line are at all hopeful—in fact, quite the reverse. This and other work in connection with fireblight has led, however, to a great deal of original investigation on the behaviour of the bacillus, and a *résumé* of some of this work may be of interest, while at the same time showing that the Biology Section of the Department is conducting research of importance with regard to the disease. On examining the American literature on fireblight one is struck by the fact that definite information on many points with regard to the organism is lacking. Much of the work of recent years has been devoted to the transmission of the disease by insects, and it has been shown that

a very large number of insects are responsible. I will now roughly outline some of the main work carried out.

Postulation of the Organism.—The first essential was to determine the exact causative organism in New Zealand. It has been definitely postulated that the disease is caused by *Bacillus amylovorus*, the cause of American fireblight. Many cross-inoculations have been carried out, and it was early shown that the bacillus on hawthorn would readily inoculate pear and apple, and *vice versa*. During this phase of the work it was found that the medlar organism was the same as that on hawthorn, pear, apple, and quince.

Extent of Twig-infection.—Owing to the fact that in many cases the cutting-out of diseased twigs did not stop the disease, investigations as to whether the bacilli could be found well below any visibly diseased part were carried out. In certain instances the bacilli were found in the tissues of the wood adjacent to the cambium at a distance of over 15 in. below any visibly diseased tissue. This fact well explains the failure that has often resulted in the cutting-back of twigs and branches. It also emphasizes the urgent necessity of sterilizing the pruning-knife, irrespective of whether apparently sound wood has been cut through or not. Without doubt a good deal of unintentional reinfection of limbs has occurred through carelessness in this respect. When pruning out diseased parts the knife must be disinfected after every cut, and where the trees dealt with are young, vigorously growing ones in which disease is spreading rapidly the fact that the cut appears to have been made through apparently sound wood is no criterion that all the diseased wood has been removed.

Insect Transmission.—It has been shown that a common Australian sucking insect, *Sephena cinerea*, is very active in transmitting the disease during the autumn months. Cultures were obtained from specimens of this insect sent to the laboratory by Dr. Tillyard and received forty-eight hours after being caught in the orchard. Mr. Waters is to be congratulated on the masterly way he has proved that this insect transmits the disease. However, with regard to insects transmitting fireblight, so many different kinds of insects have been shown to be responsible in America that it is fairly safe to assume that nearly all insect pests or insect visitors to fruit-trees are likely to spread the disease in infected districts. This being so, apart from *Sephena* no other work in this connection is contemplated. It is recognized that the total eradication of hawthorn in orchard districts is more practical than the total elimination of insects. The total elimination of hawthorn would solve to a very large extent the fireblight problem, and render the adoption of the American system of control logical.

Viability in Honey.—The question as to the length of time the fireblight bacillus would live in honey was of great importance to apiary interests, and it has been shown that its life in honey is approximately six days. The question of any danger in the distribution of honey from infected regions has thus been satisfactorily cleared up.

Viability of the Organism on and in Dried Lesions.—It is currently stated that the organism rapidly dies when the diseased tissues die and dry up. It has been demonstrated, however, that the bacillus taken from dried ooze on the bark of a lesion, and the bark kept dry in the

laboratory for nine months, remains alive. At the end of this period cultures were reared from this material. This is probably one of the most sensational announcements that have ever been made with regard to the organism.

Viability in Pure Water.—The bacillus has been kept in pure distilled water for over two months, and at the end of that period cultured successfully and its pathogenicity proved.

Action of certain Compounds on Viability.—A great deal of work on the action of certain compounds on the viability of the organism has been carried out in connection with injection studies, and many valuable results secured. Mr. Waters, who has carried out all the laboratory studies undertaken, will be shortly publishing his results, which cover also certain features regarding the organism that have not been touched on in this paper.

CONCLUSION.

In conclusion, I may say I notice from time to time statements being made that the disease in New Zealand is not fireblight, but rather a much milder disease quite different to fireblight. All that can be rejoined is that I heartily wish my critics were right and I were wrong; but, unfortunately, the facts are against any realization in this direction.

BOYS' AND GIRLS' AGRICULTURAL CLUBS.

THE SOUTH TARANAKI COMPETITIONS.

J. W. DEEM, Fields Instructor, Agriculture Department.

THE question of starting boys' and girls' agricultural clubs in Taranaki had been under local consideration for some time, and last winter it was definitely decided to go on with the work. In August the Taranaki Provincial Executive of the Farmers' Union called a meeting at Hawera of persons interested, which was presided over by Mr. R. Dunn, Provincial President of the Union, and attended by representatives of the Union, Agriculture Department, Education Board, and school-teachers. After a general discussion it was decided to start root-growing and calf-feeding clubs, and to confine these to South Taranaki for the first year. A committee representing the interest named was set up to carry out the work. It was also decided to appoint a member of the Farmers' Union in each school district to act as local supervisor or agent on the spot, who would keep a general supervision over the work, assist in the distribution of material, arrange visits of inspection, judging, &c.

In discussing ways and means the question arose as to how far the school-teachers should be asked to assist the movement, and, while it was recognized that any assistance they chose to give must be voluntary, their good will was particularly sought in giving the clubs their moral support and assisting the children to keep their records, &c.

After a season's experience I can testify to the great value of the teachers' influence in the success or otherwise of the work. The teacher has great opportunities to help and to keep up the enthusiasm of the competitors, and the success or failure of a club will to a large extent reflect the attitude taken up by the teacher. It is interesting to note that the two most successful schools this year had a lady teacher in charge, also that the champion mangold and swede crops were grown by girls.

The committee decided that for the first year the root-growing competitions should be confined to mangolds and swedes, and that the area unit be 33 ft. by 33 ft., or half a chain square. As a general principle it was laid down that this area should as far as possible be on the parent's land, but that in cases of children whose parents did not own suitable land there was no objection to their getting a plot on some one else's farm or other suitable place. In one or two instances plots were secured at the local school. It was expected that parents should plough or otherwise prepare the land, and that the competitor should then take charge and do all further work. The Agriculture Department undertook to supply each competitor with sufficient manure and seed to sow his or her plot. There was some diversity of opinion as to whether individual competitors should be allowed to choose their own variety of seed and manure, but it was finally decided that the fields instruction officers of the Agriculture Department should select the seeds and manures they thought likely to give the best results. It was considered unwise to ask the boys and girls to be experimenters, and that better all-round results would be obtained if they were given standard varieties of seed and manure. After a season's experience I am convinced that this was a very wise course, as everything possible should be done to ensure good results and eliminate the chance of poor crops or failures. For the sake of regularity it was laid down that all crops must be sown in drills 22 in. apart. The Fields Instructors of the Agriculture Department also undertook to keep a general supervision of the field-work and judge the crops. Complete instructions were prepared in circular form and issued to each supervisor and competitor for their general guidance. Associated with the officers of the Agriculture Department in this work was the Agricultural Instructor of the Education Board, who undertook the judging of the records and assisted generally.

THE 1920–21 SEASON'S OPERATIONS.

The season being advanced, it was found too late to get calf clubs going, and these were abandoned for the first year and operations confined to the swede and mangold crops. Nineteen schools entered, with 140 entries for mangolds and fifty-two for swedes, making a total of 192. In the mangold competitions eighty-two competitors completed and had their crops judged, thirty-three were failures from one cause and another (in a great many cases through father's pigs or cows getting in and destroying the crop), three were disqualified, and twenty-two failed to sow the seed. The swede competitions were not so successful, as owing to dry weather and the fact that the schools broke up shortly after seeding-time a greater proportion were failures. Of the fifty-three entries twenty completed and were judged, twenty were

failures, and thirteen were not sown. It would appear that crops sown earlier in the season, so as to be well established before the schools break up, are likely to give a greater proportion of successes than those sown just before the holidays. At the same time it must be remembered that one of the strongest reasons for establishing these plots on the home-farm is to ensure their getting attention during the holidays. The failure to give attention during the holiday period has been one of the weak spots with all school-plots in the past.

It was recognized that the land and climatic conditions were not the same in all parts of the district, and that for this reason competitors in some of the poorer districts might be handicapped as against the richer districts. The schools were therefore divided into groups, each group having as near as possible similar conditions. The following table relating to the mangold competitions shows how well the averages work out :—

Table showing the Heaviest, Poorest, and Average Mangold Crops for each Competing School; also the Average Crop for each Group of Schools, and the Average for the Whole District.

School.	Number of Crops.	Weight per Acre of Heaviest Crop.	Weight per Acre of Poorest Crop.	Average Weight per Acre for School.
Group I—		Tons cwt. qr. lb.	Tons cwt. qr. lb.	Tons cwt. qr. lb.
Mokoia	3	49 0 1 2	25 7 3 12	33 15 0 3
Ohangai	9	77 6 0 8	17 0 2 24	42 6 1 20
Tawhiti	3	27 12 3 12	14 2 3 12	22 10 0 0
Ararata	2	31 0 1 12	20 5 0 0	25 12 2 20
	17		Average for group	35 6 3 23
Group II—				
Okaiawa ..	4	62 16 3 14	7 7 3 12	31 7 2 10
Tokaora	2	48 17 0 16	41 9 1 4	45 3 0 24
Matapu	4	56 17 3 12	35 13 2 8	48 9 0 12
Mangatoki ..	2	64 12 0 16	34 17 2 0	49 14 3 8
	12		Average for group	42 9 1 17
Group III—				
Oeo	1	34 14 0 0	34 14 0 0	34 14 0 0
Pihama	4	68 6 0 8	31 0 1 12	43 15 3 16
Manaia	8	63 9 2 16	24 18 0 24	39 12 1 8
Auroa	2	44 7 0 16	38 14 2 16	41 10 3 16
	15		Average for group	40 13 0 22
Group IV—				
Kaponga ..	6	39 7 2 0	14 15 2 24	30 2 2 20
Riverlea	7	61 14 1 4	22 13 0 24	39 7 0 4
Kapuni	2	47 5 0 0	37 5 0 0	42 5 0 0
	15		Average for group	36 1 0 3
Group V—				
Rawhitiroa ..	11	73 8 0 0	14 2 0 0	36 10 3 18
Te Roti	2	55 17 0 0	30 17 0 0	43 7 0 0
Ngaere	10	47 8 0 0	21 17 0 0	33 18 3 1
	23		Average for group	36 0 0 8

Total number of crops, 82. Average crop for whole district, 37 tons 13 cwt. 1 qr. 13 lb.

PRIZES AND EXHIBITS.

Prizes were allotted as follows. Each school had a first, second, and third for its three best crops, then each group had a first, second, and third for the three best crops in the group. There were, further, three championship prizes for the three best crops in the whole district, also a handsome challenge shield, presented by Messrs. Henry Lane and Co., to be won by the school gaining most points in all clubs in one season. This shield is to be retained by the school winning it until beaten by another school.

In addition to the above the South Taranaki Winter Show Company offered a number of prizes for entries of roots from club members, also provided free space for an extensive exhibit of roots grown by the various clubs. At the Winter Show held at Hawera from 5th to 9th of this month, roots from eighty-two plots were sent forward for the general exhibition, and eighty club members made entries for the prizes offered by the company. As each exhibit consisted of three roots, a fine collection was got together. As showing the consistency of the competitors, it may be placed on record that Miss Annie Thomlinson and Miss Emily Woods, who won the championships for mangolds and swedes respectively for their field plots, also won the championships for the best three mangolds and swedes exhibited in the club competition at the show. The field-work of the clubs will teach the competitors how to grow a good crop, while the show side will educate them in selecting good roots.

JUDGING AND CROP-INSPECTION.

Judging of the crops in the field competitions was carried out at the end of April. The following scale of points was used and appeared to work out satisfactorily: one-half point for each 5 cwt. of roots, together with a maximum of 10 points for quality, 20 for cultivation, and 40 for records. Cultivation and records were made the strong features of the work, hence the liberal number of points given under these headings. In judging it was generally found that the competitor who gave most care to the crop also kept good records. For instance, the winner of the mangold competition, Miss Annie Thomlinson, had a crop which worked out at the rate of 77 tons 6 cwt. per acre, giving her 154½ points for weight; she also secured 17 for cultivation, 9 for quality, and 35 for records: a total of 215½ points. On the other hand, taking one of the poor crops, weighing 26 tons 16 cwt. per acre, the points for weight are 53½, cultivation 12, quality 6, and records 18: total 89½ points.

During visits of inspection and judging of crops the local supervisor invariably arranged that all the competitors (and in many cases a number of the younger children who are likely to become club members next year) accompanied the general supervisor and judge from plot to plot. This afforded the competitors an opportunity of comparing one another's work, and, by listening to the remarks of the supervisor or judge, of learning what should be done to get the best from their plots and why points were taken off in judging. In several instances during the judging the supervisors of adjoining clubs brought their members along, and thus gave them an opportunity of comparing crops in other districts with their own. This had the effect of arousing keen rivalry, and many a competitor who had a poor plot, on seeing a good

one and listening to the complimentary remarks of the judge, made a resolve that he would do better next year. This is a phase of the work that should be encouraged, for after listening to the remarks of the competitors I can vouch for the great benefits derived.

FUTURE DEVELOPMENTS.

The club movement bids fair to extend widely. Already North Taranaki has decided to follow the southern end of the district, and clubs for mangold and carrot growing are to be taken in hand. Wanganui is also considering the movement. The number of clubs in South Taranaki promises to show a big increase this year. For the coming season it has been decided to replace the swede competitions by carrot-growing. Calf clubs are also being started and are attracting good entries.

From the past season's operations we have learnt quite a lot, and can now tackle the work with more confidence. For new districts I would advise starting in a small way; also recommend that something of a simple nature and suitable to the district be chosen; that care be taken to enlist the co-operation of all interested, and that live men are selected to act as local agents or supervisors in each school district. Given these factors, the success of the clubs may be regarded as assured.

In conclusion, I should like to place on record the cordial relations that have existed between the Farmers' Union, school-teachers, supervisors, and Instructors of the Education Board and Agriculture Department. All have worked with the greatest unanimity to make the movement a success, and, while it has meant increased duties to some, I am sure that they feel fully repaid by the good results achieved.

"*Digest of the Land Laws of New Zealand.*"—A supplement to this publication, containing amendments made by legislation of 1920 and the first session of 1921, has been prepared by the author, Mr. W. R. Jourdain, and issued from the Government Printing Office.

Quarantine Regulations.—The regulations under the Stock Act relating to quarantine have been amended by declaration that in respect of any cattle, sheep, or goats introduced into New Zealand from the United Kingdom the period of quarantine shall be deemed to commence immediately after the expiry of the day on which such stock are inspected by a Government Veterinarian at the port of arrival.

"*Donatory Members*" *of the International Institute of Agriculture.*—In order that tangible gratitude may be expressed towards persons making a donation or legacy to the Institute, the Permanent Committee has taken power by resolution to confer the title of "Donatory Member of the International Institute of Agriculture" upon any donor of such gifts equalling £400 or more in value. The names of such donatory members will be inscribed on a marble plaque, which will be placed on the wall of one of the halls or in the vestibule of the Institute. The title is not to be conferred except after special report and a three-fourths vote.

STANDARD FRUIT-GRADING AND PACKING.

GROUND-PLAN OF PACKING-HOUSE AND AIR-COOLED STORE.

J. A. CAMPBELL, Director of the Horticulture Division.

As our fruit industry develops, competition between districts, groups, and individual growers naturally tends to become more keen, prices fall, and the grower often becomes discontented with his lot. This state of affairs must be expected in any industry when the supply begins to equal or exceed the readily available demand. In these circumstances the fruitgrowing industry is at decided disadvantage as compared with other agricultural pursuits, which in many instances can be readily diverted into other channels without excessive loss or inconvenience; whereas an orchard takes years to develop, and, when established, becomes to the owner practically a permanent undertaking.

A satisfactory demand is therefore essential to the fruit industry, and it is for the grower to adopt such methods as will create and maintain that demand, either by improving his methods of local distribution or by arranging to export his surplus fruit to oversea markets where such a demand may exist; or, better still, by adopting both methods; but, above all, by avoiding the erroneous impression which appears to be held by some growers that falling prices can to any degree be met by placing on the market an article of correspondingly low quality.

The American fruitgrower was long since called upon to face this position. In that country it very soon became obvious that the local markets could not be anything like fully developed so long as the standard of packing varied as widely as the opinions of the various growers and groups. Buyers could not operate with that freedom necessary to move the large annual crops produced except by cutting prices, in order to avoid possible losses due to unsatisfactory packing. Consequently standard packing was advocated, and, although strongly opposed by a very large section of growers as being a practical impossibility, the proposal after many years of educational demonstrational work became an established practice, and, as far as the western States are concerned, has for several years been made compulsory by law. In that section of the United States growers and merchants alike unhesitatingly declare that standard packing was the base on which the successful fruit industry of the west was built, and that without it the fruit industry would have undoubtedly collapsed. The success of standardization in America is exemplified by the fact that hundreds of thousands of cases of apples are now being bought and sold without any special inspection at all, but on the grade-mark only, and also that under this system Washington State alone in the season of 1919 successfully disposed of an apple crop of over twenty million cases.

The New Zealand fruitgrower wishes, and will no doubt be shortly compelled, to widen the distribution of his fruit. There is a growing demand for the compulsory standard grading and packing among the

growers of this country. Such conditions have already been made compulsory in relation to fruit for export, and similar conditions have been prepared for voluntary adoption in connection with the sale of fruit within New Zealand. To prepare and issue compulsory grading and packing regulations is one thing, but to satisfactorily enforce them is quite another matter, especially pending the education of growers generally on the altered conditions. To introduce such regulations and to fail in their proper enforcement—a matter that would surely occur unless the present departmental staff were considerably strengthened—would give the movement such a setback as to rob it of its possible value for many years or wreck it altogether. However, the voluntary scheme still remains, and it is the hope of the Department that all those growers who have the facilities will, on their own initiative, grade and pack their fruit in accordance with the standards provided, and thereby induce others by actual demonstration to follow their example.

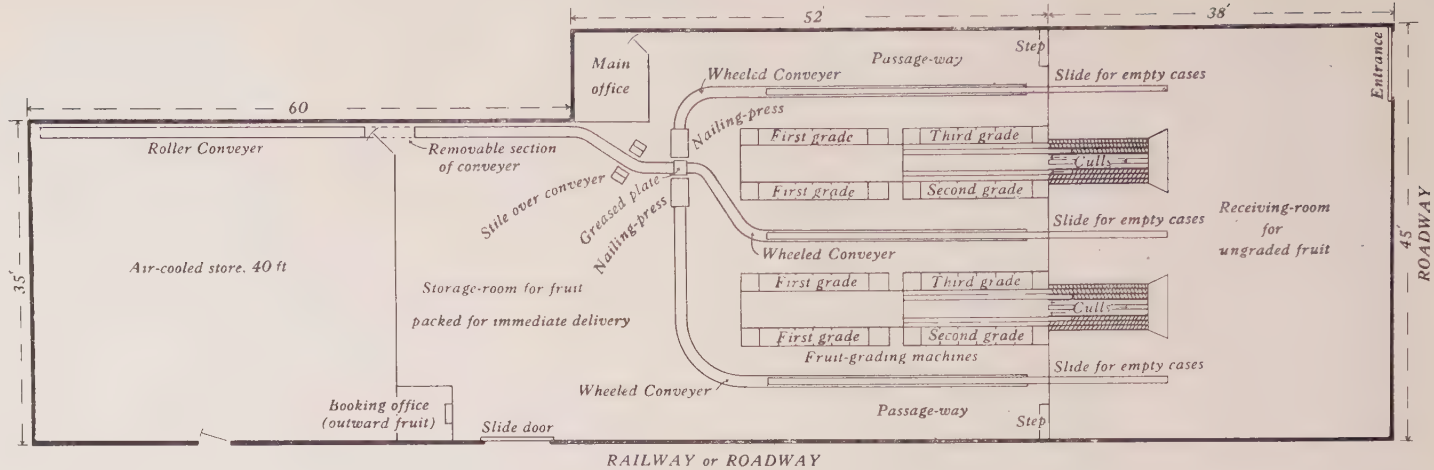
Although there is no reason why standard grading and packing could not be satisfactorily practised by the individual orchardist in his own packing-shed, the group or community system is calculated to give more satisfactory results. Under this system the fruit is assembled at a community and central packing-house, and is there graded and packed by a trained packing staff, and consequently a higher degree of uniformity is maintained. The requirements of export, and a general tendency toward improved packing for the local market, have resulted in quite a number of packing associations and groups being formed, together with the erection of the necessary packing-sheds. Also, judging from the number of applications being made to the Department for plans of such sheds, quite a number of such undertakings are under consideration, and so no doubt it will go on as the more recently planted orchards reach maturity.

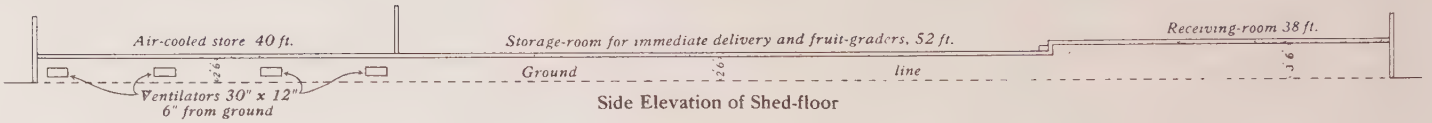
The central-packing system tends to greater efficiency, while, as far as the pack is concerned and where sufficient fruit is available, it should also tend towards economy. To ensure the latter factor, however, very careful consideration must be given to the cost of establishment and maintenance in conjunction with the quantity of fruit the concern has to handle. A costly building programme may easily cripple the venture at the outset. Other causes of failure are mainly to be found in connection with the shed-management. Lack of method in the store itself not only leads to confusion and unnecessary labour, but also militates against the efficiency of the packing staff. The packing-house should be planned with a view to methodical working, and, as indicated, should be on lines corresponding with the quantity of fruit available. Where the supply is adequate the house should be designed on up-to-date lines, including the popular labour-saving appliances which are to be found in all the leading packing-houses of America.

DESIGN FOR PACKING-HOUSE FLOOR AND STORE.

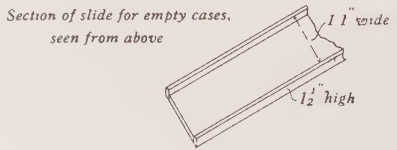
The accompanying plan of a fruit-packing house and natural air-cooled store is suggested as a result of observations made in America, modified to suit New Zealand conditions. This house, fully staffed, should be capable of turning out approximately two thousand packed cases per day. This exceeds the quantity likely to be handled by

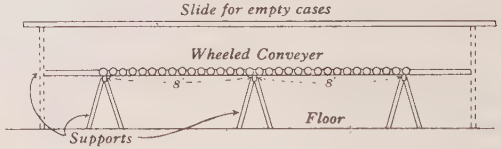
GROUND-PLAN OF FRUIT-PACKING HOUSE AND AIR-COOLED STORE.

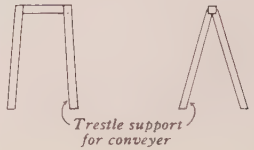



Air-cooled store 40 ft.
Storage-room for immediate delivery and fruit-graders, 52 ft.
Receiving-room 38 ft.
Ground line
Ventilators 30" x 12" 6" from ground

Side Elevation of Shed-floor







Section showing Slide for Empty Cases over Conveyer

any of our associations for some time to come, consequently the plan is not suggested for adoption in its entirety, but mainly for the purpose of setting out the idea, which is amenable to modification to suit individual requirements. For instance, the grading and sizing machines are of the largest size. If one is sufficient in the meantime the space occupied by the second may be used for storage purposes, the additional machine to be installed should future developments warrant it. If the smaller-sized machines are installed the building may be reduced in size accordingly, and so on, working down to a single small-sized machine and reducing the size of the building, if so desired, in like proportions.

The fruit from the orchard is received in the room (1) shown on the right of the plan, the door of which is in the corner. The object of this is twofold—firstly, for the purpose of retaining the maximum of unbroken wall-space for the storing of ungraded fruit received from the various growers, and, secondly, so that in the event of further storage-accommodation being required (which is recommended to be built at right angles to the room shown) the door will be in a convenient position to serve the whole. The storage-space for ungraded fruit is divided into sections, each of these being designated alphabetically. Each section is divided into tiers, and these are numbered, say, from 1 to 20. A tier represents a pile, one case wide and six high, extending from the wall to the extreme boundary of the stack.

The loose fruit is delivered to the store in clean new cases. These cases, which should bear the grower's registered number, are used in connection with the repacking of the fruit after grading and sizing. The cases are taken from the wagon, stacked six high on the floor, and are picked up by means of a "clamp truck" and run off to, say, section D, tier 4, or wherever the shed storeman instructs. This method of stacking is methodical and eliminates confusion.

Later, when this fruit is being put over the grading-machine, the truckmen using the clamp truck simply pick up each set of six cases forming the tier and place them at the end of the machine. The contents of each case are emptied on to the grading-table, and the empty case is placed in a slide which runs along directly over the top of the conveyors. Case after case is forced along this slide until it is completely full. When the packer wants an empty case he merely reaches up and takes one from the slide above. This method, while readily providing the packers with the empty cases they require, obviates the litter of empty cases so often found encumbering a packing-house floor.

Each packer is given a number and a supply of white celluloid cards bearing that number. The packer places one of these cards marked with the grower's number, and the grade, variety, and numbers of fruit, in the end of each packed case, after which the package is transferred to the wheeled conveyor, and is carried by gravitation to the nailing-press or the greased plate. The pressman receives the case from either point, and places it on the nailing-press. He then marks it, by means of rubber stamps, with the grade-mark, variety, and number of fruits as shown on the packer's card. The latter is tossed into a receptacle, from which all the cards are later collected and used for checking the number of packed cases of the different grades to be

credited to the grower, also the number of cases packed during the day by the packer. The cards may then be sponged, sorted, and returned to the respective packers according to number, in readiness for the following day's work.

After being nailed down the cases are placed on the roller conveyer and are conveyed to the ordinary store for immediate shipment, or to the cool store. Labelling is usually done before the case is removed from the roller conveyer for stacking.

MARTON EXPERIMENTAL AREA.

NOTES ON OPERATIONS FOR SEASON 1920-21.

J. W. DEEM, Fields Instructor, Wanganui.

THE weather during the spring of 1920 was very unsatisfactory for working the Marton Experimental Area. Rain, at times very heavy, fell with great regularity, and this delayed all farm operations. After some of the crops were sown the heavy downpours had the effect of partly drowning out certain of the plots. On the other hand, the weather during harvesting operations was very good, and all the crops were saved in first-class condition.

The crops grown consisted of 9¾ acres of Algerian oats, 2½ acres of Gartons' oats (ten varieties), 12 acres of wheat (five varieties), 2½ acres of peas (three varieties), 9 acres of barley (two varieties), ½ acre of Japanese millet, ½ acre of Sudan grass, 1 acre of Silver King maize, and 1 acre of rape. In addition, nineteen varieties of swedes and fourteen varieties of soft turnips were tested for disease-resistance. Five varieties of sugar-beet were also grown.

Oats.—The Algerian oats were sown on 13th May, 1920, and harvested in December. These were grown chiefly for feeding the horses on the farm. The other oats were some new varieties bred by Messrs. Garton, which came to hand very late from England and were sown in small plots for seed purposes. The names of these oats are as follows: Captain (new breed), New Abundance, Leader (new breed), Hero (new breed), Record (new regenerated breed), Yielder (new regenerated breed), Goldfinder (new regenerated breed), Supreme (new regenerated breed), Black Oat Bountiful (regenerated breed), and Black Tartarian (regenerated breed). Certain of the varieties—namely, Record, Supreme, Black Oat Bountiful, and Black Tartarian were rather badly rusted. Some of these oats may be further tested at Marton this year, and all will be grown in the South Island.

Wheats.—The wheats, with the exception of Major, were sown on 25th August, and Major on 31st. The varieties matured fairly evenly, and were harvested during the last ten days of January, 1921. The wheats grown were Major, Marquis, Currawa, John Brown, and Fison's Blue Chaff. Marquis gave the heaviest yield, with 45 bushels per acre; Currawa was second, with 43½; Major third, with 36⅔; while John Brown gave 35 bushels, and Fison's Blue Chaff 22½ bushels. The last-

mentioned wheat was very open in the husk, and was greatly preyed on by birds. Further, it dropped badly, and between the birds and the dropping it is estimated that between 12 and 15 bushels per acre was lost. The average yield over the whole wheatfield was 35 bushels per acre. Major occupied the largest area, and was grown on the poorest portion of the field; this no doubt accounts for its smaller yield when compared with Marquis and Currawa. It is interesting to note that the average yield for Major and Marquis for the past three years on the Marton Area was 48¼ bushels and 41⅔ bushels respectively. To keep a check on the results of Major I have collected the threshing returns from 150 acres grown between Waitotara and Marton last season, and they give an average yield of 52 bushels per acre. From these data it would appear that Major is going to be a very suitable wheat for this coast. It thrives well under adverse conditions, is not too bulky in the straw, and stands up to the weather. From what I can hear, all available will be sown this year. Marquis also promises to be a very useful wheat for North Island conditions.

Barleys.—Barleys were sown on 10th and 11th November, and were cut on 10th and 11th February, just three months from the date of sowing. The black variety threshed 41¼ bushels per acre, and the brown 30 bushels, against 48 and 36 respectively last year. It will be noted that for the two seasons the black gave a big increase over the brown, and it is not intended to grow the latter in future. Farmers are finding out the value of black skinless barley for early green feed, and there is now a good demand for seed. It is certainly the quickest of all cereals on this coast.

Peas.—A half-acre each of Grey Partridge, Canadian Field, and Arthur peas were grown for seed, and these were saved in excellent condition. The yields per acre were Grey Partridge 40½ bushels, Canadian Field 34½ bushels, and Arthur 30⅔ bushels. The Canadian Field and Arthur seed sown germinated badly, otherwise the comparisons of yields would probably have been in their favour. We have some splendid seed for next season.

Feeding Tests.—An acre of Grey Partridge peas and an acre of rape were grown side by side for a feeding experiment. These crops were sown on 25th November, but, as the weather was wet and the land still cold, growth was very slow. When warmer conditions set in the peas came away and produced a fair crop, but the rape was poor. The crops were ready for feeding on 1st March, and a line of fifty-five "bush" lambs were divided and put on the plots on 6th March—twenty on the rape and thirty-five on the peas. At the end of fifteen days the rape was finished and both lots of lambs were weighed. Those on the rape showed a total gain in weight of 224 lb. (average 11¼ lb. per head), against 301 lb. (average 8½ lb.) for those on the peas. It should be noted that during this test the weather conditions were ideal for the purpose, and the lambs were supplied with plenty of clean drinking-water.

A further feeding test was conducted between Sudan grass and Japanese millet. Half an acre of each was sown on 6th December. For the first three weeks the growing-conditions were bad, and this, coupled with the fact that the seed was of low germination quality, greatly reduced the stand of both crops. The areas were ready for

feeding by the middle of January, but it was the 28th before lambs could be procured, and on this date six lambs were put on each plot. At the end of fifteen days all the lambs were weighed. Those on the Sudan grass showed a gain of 5·83 lb. per head, and those on the millet 5·16 lb. The number of lambs on each area not being sufficient to cope with the feed, a further twenty lambs were secured on 15th February, and twelve of these placed on the Sudan grass and the remaining eight on the millet. All lambs were again weighed on 28th February, when those first on the plots showed a further gain of 6·24 lb. per head on the Sudan grass, and those on the millet 8·14 lb. per head —in other words, a total gain of 12·07 lb. and 13·3 lb. respectively. The lambs put on on 15th February showed a gain of 1·9 lb. per head on the Sudan grass and 2·5 lb. on the millet. The twelve lambs first used were sent away fat and the other twenty turned out on wheat stubble until 9th April, when they were again weighed on to the respective plots. At the end of eleven days those on the Sudan grass had cleaned up the second growth, but unfortunately could not be weighed then on account of wet weather. They were all weighed two days later, but owing to shortage of feed those on the Sudan grass had gone back somewhat. The weights disclosed gains of 0·04 lb. per head on the Sudan grass and 4·08 lb. on the millet. This gives a total return for the half-acre of millet of 137·8 lb., and 103·8 lb. for the half-acre of Sudan grass. The gains for the Sudan grass were no doubt reduced owing to the failure to weigh at the right time, and, while the sheep ate this grass in preference to the millet, it would appear as if the latter contains better fattening-qualities. It is proposed to repeat this test on a larger scale next year. It should be mentioned that all lambs are penned up fifteen hours before being weighed.

Swedes and Soft Turnips.—These were new varieties and were tested for disease-resistance, but out of the nineteen varieties of swedes and fourteen of turnips not one stood out as disease-resistant. They were all more or less attacked by club-root and dry-rot.

Haying-pasture. — Five acres of temporary pasture—Italian rye-grass and red clover in its third year—was closed on 18th October, cut for hay on 13th December, and saved in good condition. Several average areas were weighed at time of cutting, and these worked out at 12 tons 17 cwt. per acre of green material. This consisted chiefly of red clover just coming into bloom, and the fact of it being very sappy accounts for the heavy weight. The percentage of rye is greatly reduced this year, but the clover seems as strong as ever. It should be mentioned that one of the main objects in carrying on this pasture for hay purposes is to test it against an adjoining area of lucerne sown in the same season, in order to ascertain which will give the most profit over a period of years on land with a stiff cold subsoil like that of the Marton Area. The hay from the above-mentioned cut, when pressed, weighed $11\frac{1}{4}$ tons, this averaging out at the rate of $2\frac{1}{4}$ tons per acre. After the hay was cut the field was again closed up and the second growth, which was practically pure clover, was cut for seed on 17th March. The five acres yielded 743 lb. of dressed seed, or $148\frac{3}{5}$ lb. per acre. It should be mentioned that the field carried 101 sheep for the period 4th to 18th October, on which date it was first closed up, and it was again available for grazing at the end of March.

Lucerne.—An acre of Marlborough lucerne sown on 18th December, 1918, was cut three times during the season. When laid down this area was divided into four equal parts and the plots sown broadcast, in 7 in., 14 in., and 21 in. drills respectively. The three cuttings gave the undermentioned weights of green material per acre: Broadcast, 17 tons; 7 in. drills, 17 tons 5 cwt.; 14 in. drills, 17 tons 6 cwt.; and 21 in. drills, 14 tons 14 cwt. The acre of lucerne sown last year to test the capabilities of the Grimm against the Marlborough variety has done well, but up to the present neither variety has shown any superiority over the other.

Eradication of Couch.—A further area of 10 acres, which was badly infested with couch-grass (*Agrostis stolonifera*), was summer-fallowed, and sown on 6th April with a mixture of Italian rye-grass 15 lb., perennial rye-grass 10 lb., and red clover 5 lb., per acre. At the time of writing the whole field is overrun with spurrey (*Spergula arvensis*), and not much grass or clover can be seen.

TESTING OF PUREBRED DAIRY COWS.

CERTIFICATE-OF-RECORD LIST FOR THE HALF-YEAR.

W. M. SINGLETON, Acting Director of the Dairy Division.

THE following lists comprise the records of C.O.R. dairy cows which have qualified for certificate during the half-year 1st January to 30th June, 1921. The numbers are comparatively small owing to the fact that few cows complete their test during the first six months of the year. It will be noticed, however, that some excellent yields have been made in each of the breeds represented.

RECORDS FROM 1ST JANUARY TO 30TH JUNE, 1921.

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	JERSEYS.	Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old.						
Roslyn Miss Rose ..	A. Best, Bombay ..	2 46	245·1	365	7,551·4	452·72
Tuneful	J. Haie, New Plymouth	1 170	240·5	365	7,656·5	433·20
Louise	Mrs. M. Spinley, Palmerston North	1 348	240·5	365	7,963·5	403·56
Julie	John S. Jones, Bell Block	1 363	240·5	273	6,450·5	350·28
Fiancée	Mrs. M. Spinley, Palmerston North	2 47	245·2	365	7,241·6	334·47
Morva	Bentley and Sons, Kaponga	1 335	240·5	306	5,468·0	308·38
Falconite's Flora ..	F. J. B. Ryburn, Ohaupo	2 0	240·5	290	5,383·9	287·77
Springbank Mona ..	E. S. Holdaway, Pahiatua	1 207	240·5	365	5,333·9	284·98
Senior Two-year-old.						
Zerza	Mrs. Rogers, Katikati	2 312	271·7	265	5,929·5	313·88

MANIAROA PRINCESS.

C.O.R.: Mature; in 365 days, 15,951·7 lb. milk 700·76 lb. butterfat.

MEADOWVALE PEGASUS.

C.O.R.: 3 years 47 days; in 324 days, 10,247·2 lb. milk, 618·72 lb. butterfat.

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	JERSEYS—*continued.*					
Three-year-old.		Yrs. dys.	lb.		lb.	lb.
Alma	A. R. Clark, Hamilton	3 228	299·8	334	7,902·0	506·71
Copper Coin of Woodstock	H. G. Livingston, Kiwitea	3 23	279·3	365	8,684·8	447·09
Gamboge's Wonder..	J. K. Richards, Lowgarth	3 40	281·0	365	6,537·7	411·97
Pride of Tumanako..	P. F. Kelly, Timaru	3 137	290·7	321	6,943·5	373·79
Four-year-old.						
Riverside Sweetberry	J. T. Belcher, Cardiff..	4 65	320·0	365	8,005·9	440·17
Mature.						
Jersey Bank Treasure	J. Hale, New Plymouth	10 15	350·0	365	13,204·0	717·02
Dark Prim ..	J. Hale, New Plymouth	7 228	350·0	365	12,596·7	655·03
Belle Mahone ..	A. J. Luxton, Omata..	6 15	350·0	257	7,693·5	418·29
Welcome Surprise ..	Miss MacLean, Feilding	5 192	350·0	327	6,900·95	401·39
	FRIESIANS.					
Junior Two-year-old.						
Rosevale Beauty Posch	H. North and Sons, Omimi	2 24	242·9	365	13,696·8	437·85
Senior Two-year-old.						
Rosevale Burkeyje Sylvia	H. North and Sons, Omimi	2 185	259·0	365	16,649·9	666·69
Rosevale Sylvia Keyse	H. North and Sons, Omimi	2 268	267·3	365	16,965·7	533·50
Junior Three-year-old.						
Dominion Imarose ..	Gibb Bros., Clifton ..	3 50	282·0	297	10,740·0	375·79
Senior Three-year-old.						
Martha Johanna Rue	W. Barton, Featherston	3 317	308·7	365	15,967·1	549·17
Oakwood Vanity ..	W. D. Hunt, Invercargill	3 282	305·2	365	13,013·0	461·79
Everslea Princess ..	R. Newell, Rangiora ..	3 251	302·1	326	11,482·4	389·44
Junior Four-year-old.						
Riverlea Duchess ..	C. H. Steadman, Waikiekie	4 25	316·0	365	13,249·4	457·90
Mature.						
Oakwood Rambler ..	W. D. Hunt, Invercargill	6 252	350·0	365	23,952·6	820·93
Princess Pauline Segis	H. W. Hoskin, Mangatoki	7 1	350·0	365	20,271·1	671·35
Bainfield Rose ..	W. D. Hunt, Invercargill	7 21	350·0	365	12,562·1	409·13
Cluny Hengerveld Rongotea	Cluny Friesian Farm, Trentham	5 53	350·0	365	10,294·6	377·35
	MILKING SHORTHORNS.					
Mature.						
Maniaroa Princess ..	Messrs. Ranstead Bros., Matangi	..	350·0	365	15,951·7	700·76
Lady Julia of Dungiven	W. F. Jacob, Kiwitea	..	350·0	350	10,929·1	475·75
	SECOND-CLASS CERTIFICATES.					
	JERSEYS.					
Junior Two-year-old.						
Fascination ..	Geo. Buchanan, Paeroa	1 221	240·5	365	6,076·3	315·63
Mature.						
Lady Peggy ..	E. Griffiths, N. Plymouth	7 180	350·0	365	10,212·0	670·85
Delphine of Sedgebrook	S. R. Lancaster, Palmerston North	5 95	350·0	346	8,896·25	563·07

WORK FOR THE COMING MONTH.

THE ORCHARD.

THE RECENT CONFERENCE.

MANY matters of importance to the fruitgrowing industry were dealt with by the Fruitgrowers' Federation Conference held at Wellington last month. Among them were the questions of renewing the Orchard-tax Act, fireblight, standard fruit-cases, and fruit-case supplies.

The renewal of the orchard-tax was considered by the conference to be of first importance. The continued existence of the Federation, which is primarily financed from proceeds of this tax, was held to be more necessary now than at any other time in view of the many interesting problems facing the industry, consequently the vote favouring a renewal of the Orchard-tax Act was carried unanimously.

A considerable amount of the time of the conference was devoted to consideration of the fireblight problem. Very interesting addresses on the subject were given by Professor Foster, at one time Entomologist to the State of California, and by Mr. A. H. Cockayne, Biologist to this Department (whose paper appears elsewhere in this issue). After deciding on a plan of campaign the conference decided to advance all the available orchard-tax funds in the hands of the Federation towards work designed in the interests of growers in those districts threatened by the disease. A deputation from the conference later waited on the Minister of Agriculture for the purpose of putting their views before him and seeking his assistance.

A good deal of discussion also took place relative to standard fruit-cases. The adoption of the ¾-bushel case proposed by the previous conference was confirmed. Certain other resolutions in this connection were carried, but on the whole the standard cases previously adopted withstood criticism very well, and there is likely to be little change. The inside measurements of the ¾-bushel case are to be 8½ in. by 10 in. by 19¾ in.

MR. KIRK'S RETIREMENT.

Mr. T. W. Kirk, who has been in charge of the Horticulture Division as Director for many years, retired from active service on 30th June. Mr. Kirk's strong assistance in all that concerned the interests of the horticultural industries of the Dominion is well recognized by those with whom he came in contact during his long term of office. He was the recipient of a handsome present from the members of the Fruitgrowers' Conference, and also of similar tributes from several other societies with which he has been officially associated. It is evident that Mr. Kirk is carrying with him in his retirement the good wishes of the fruitgrowers, beekeepers, nurserymen, and a host of other friends in the Dominion.

—J. A. Campbell, Director of the Horticulture Division.

AUCKLAND.

Pruning-work should be well forward by this time in most orchards, and be completed as early as possible, all the prunings being picked up and burned immediately.

The planting of new areas with fruit-trees, and also of shelter-trees in belts, should be completed without further delay. Citrus-trees which were not planted out in autumn owing to the probability of frost injury during the winter months must be put out at the earliest opportunity.

As soon as the soil and weather conditions are suitable the early spring ploughing should receive attention. It is advisable to plough the orchard "lanes" only one way during the early spring, leaving the cross-ploughing until late spring, when the first ploughing will have been harrowed down some six weeks. If done sooner the value of the clover or other green manure turned in for humus at the first ploughing will be much depreciated.

Grafting should be completed as the sap rises. Select scion wood from good healthy vigorous trees only.

The application of oil sprays for the control of sucking-insects has been found to give better results if deferred until the very first signs of early bud-movement in apples and pears. This spray should be applied at rate of 1–12 or 1–14. A close watch must be kept upon the stone-fruit trees at this juncture, and as soon as the buds show pink and white in peaches, nectarines, and plums respectively the usual early spring application of bordeaux, 8-6-40, should be applied. Loganberry plots and strawberry beds should be sprayed now with bordeaux, 4–4–40, to protect plants against fungoid attack.

Fireblight.—Owing to the presence of fireblight infection in several localities in the Auckland District, growers are recommended to take all precautions against spreading the infection from tree to tree in the orchard when carrying out pruning operations amongst pip-fruit trees. As a precautionary measure all orchardists—both domestic and commercial—are advised to immerse the pruning-tools in a sterilizing solution consisting of formalin 1 part to water 20 parts. Mix and keep this solution in a convenient wide-mouthed receptacle, so that the instruments can be readily dipped. Quick immersion will be sufficient to kill any organisms likely to be present. For disinfecting areas on the trees that have been cut, use corrosive sublimate 1 part to water 1,000 parts, applied with a small brush. This is a deadly poisonous compound, and should not be left lying about. Keep it in a glass or earthenware receptacle, not in a tin, and do not dip knives or secateurs into it, as metals decompose in this compound. As a wound-covering after sterilization with corrosive sublimate use pure coal-tar, applied with a stiff brush. It is practically harmless to the tree, and when coated on the wound prevents the entry of parasitic fungi. I would like to make a final appeal to all those orchardists (especially those in commercial areas) who may have hawthorn, or any member of the *Crataegus* family, growing upon their properties to grub the same out by the root without further delay. This work is actually more important at this stage than the completion of pruning of the pip-fruits, as, if the hawthorn remains and is infected with fireblight, there will in all probability be little need for scientific pruning of pip-fruits next season.

—J. W. Collard, Orchard Instructor, Auckland.

HAWKE'S BAY.

Pruning: This should receive first consideration, and every effort made to complete the work as early as possible. All prunings should be carefully gathered and burned.

Planting: This work is best completed early in August. On no account plant trees when the soil is sticky, as to ensure good results the soil must be firmed near the root area, and this can only be done when the ground works freely.

Spraying: Towards the end of August the delayed dormant spraying will need attention. Almond and apricot, followed by peach, plum, and nectarine, show early bud-movement, and should receive an application of bordeaux, 8-6-40, when the majority of the buds show colour, to safeguard against leaf-curl, rust, and shot-hole. For stone-fruit trees infected with scale insects and aphis the bordeaux may be applied at the first sign of swelling buds, and oil, 1–20, applied soon after. For various scale insects and aphis on pip-fruits the best results are obtained by an application of oil, 1–17, at the first sign of bud-movement; this takes the place of the midwinter spraying at a much greater strength which was usual a few years ago, and has been found to give very satisfactory results. Should it be decided to refrain from the use of oil for any reason lime-sulphur, 1–10, should be substituted.

Cultivation: Cover-crops should be turned under and the early spring ploughing done where the soil conditions will allow. Care should be taken not to leave open furrows near the base of the trees; work the land to fill them up without delay.

—W. H. Rice, Orchard Instructor, Hastings.

NELSON.

About the middle of August stone-fruit trees will be breaking into new growth, and about the same time in September the pip-fruits will be making a start. Pruning generally should be completed before these dates. Of the many problems with which the pruner has to deal, perhaps the most important is to see the leader-

tops are not overloaded with fruit, or crowded with growth to the extent of unduly shading the lower parts of the trees. The first will break down and destroy the leader, and the second will render the shaded portions unfruitful. An admirable achievement of the skilful pruner is to maintain the vigour and fruitfulness of the spurs and fruiting-laterals about the base of the tree. That is where the strength of the tree lies; if a large crop is to be borne, that is where the bulk of it must be placed. Lay aside a good supply of wood for any grafting that has to be done later. About the end of the month prune orange and lemon trees.

With August the spraying season opens, and growers are reminded of the importance of the early applications. It has been stated that 80 per cent. of efficiency is obtained by the two earlier sprays, and this is hardly an exaggeration. If these opportunities are missed they cannot be made up. Before the stone-fruit trees renew their growth an application of bordeaux, 8–6–40, is indispensable. Should scale, aphides, or red mite have been troublesome an application of red oil, 1–20, should follow. A further application of bordeaux, 6–4–50, should be applied when the flower-buds commence to open. Results will depend largely on the care with which the mixture is made and the thoroughness of the application. Gooseberries and bush-fruits generally should receive similar treatment. Strawberry-plants will require an application of bordeaux, at what is known as summer strength, 3–4–40. The spraying of pip-fruits is best reserved until next month.

Push ahead with planting as the land is prepared and weather permits. See last month's notes regarding cultivation.

Hares are troublesome among young trees at this season of the year. Wire netting is the best defence against this attack, but it is necessary to examine the fences carefully and see they are secure. Hunt through any cover for hares that may be enclosed with the orchard. A strong spray mixture has often been found sufficient to render young shoots distasteful to these animals.

Many growers are still holding a portion of last year's crop; by the end of this month all the earlier sorts should be quitted. It is necessary that the consumer should have the fruit in prime condition. To do this, King David, Jonathan, Delicious, and other autumn sorts should be about cleared by the end of the month, leaving Dougherty, Sturmer, and such late varieties for the spring market. —*W. C. Hyde, Orchard Instructor, Nelson.*

NELSON CENTRAL.

Where large areas have to receive attention it will be necessary to have the spray-pumps in operation probably towards the end of August. Before starting out on the spraying programme see that the outfit is properly overhauled and hoses in good condition. Unless good care has been taken of them in the interval between seasons trouble is sure to occur. It pays to start out with good hose, especially where oil sprays are in use: the old hose can be finished out during the summer spraying.

Though stone-fruits are not largely grown in this district, those we have should receive attention to prevent attacks of leaf-curl, bladder-plum, and shot-hole fungus. The best remedy is bordeaux, 8–6–40, as the buds are swelling. Alternatives are bluestone solution (1 lb. bluestone dissolved and added to 16 gallons of water), or lime-sulphur, 1-8. If green aphis has been troublesome the previous season, or red mite and San Jose scale are present, an oil spray at 1–17 should be applied a fortnight prior to the fungicidal spray. Bright sunny weather should be chosen for the application of oil sprays, as penetration is much better in warm weather.

Pear-trees requiring treatment for insect pests should be sprayed before apple-trees, as the buds are more porous and liable to injury if left too late. Where pear-mite has been in evidence an oil spray at 1–12 should be applied to destroy the eggs which have been deposited in the bud-crevices, as this mite is not easily dealt with when it gets into the leaves. Apple-trees can be left until next month.

Do not leave the prunings from trees lying around, as is often the practice: it is useless spraying the trees if this means of reinfection is allowed to exist. Gather and burn all prunings as soon as convenient. Do not stack them round the headlands to allow insect-eggs to hatch and fungus spores to germinate, and so nullify the results of the spraying.

—*J. H. Thorp, Orchard Instructor, Mapua.*

MOTUEKA.

Pruning should be finished as early as possible, and all prunings gathered and burned. Scions that are required for regrafting later in the season should be preserved by being kept in a cool and sheltered position with their butt ends placed in the ground to retain the sap moisture.

The spray-pump will now have to be brought out in readiness for the new season's spraying. The application of red-oil emulsion at a strength of 1–8 to 1–10 is recommended where scale insects are prevalent. Weaker strengths applied at later stages have been suggested, but the above has been well tried and proven successful, and is strongly recommended as being most effective in dealing with bad attacks of scale insects. Other spraying measures necessary will be the application of bordeaux, 8–6–40, to stone-fruit trees, with the object of preventing attacks of fungus diseases, such as leaf-curl and shot-hole.

Where new planting is contemplated, this work should be put in hand now. For preference, strong yearling rods from which to build up sturdy trees are recommended. These should be headed back to a height of about 15 in. from the ground after planting. Where two-year-old trees are being used for planting, three good branches should be selected on which to build the framework of the future tree. These should be cut back, leaving only about 3 in. or 4 in. of growth on each, and all other growth removed entirely.

—W. T. Goodwin, Orchard Instructor, Motueka.

CANTERBURY.

Pruning: Where possible this work should be completed by the middle of August. Gather and burn all prunings, and thus eliminate a source of disease infection.

Spraying: Trees affected with woolly aphis and mussel scale should be thoroughly sprayed at once with red-oil emulsion, 1–20, and again early in September just before the dormant buds burst open. Good results have been obtained in a local orchard by mixing the emulsion in the following manner: Boil ½ lb. of Sunlight soap and 2 oz. of washing-soda in 5 gallons of water until the soap is dissolved. The soap will dissolve readily if thinly sliced. Pour the hot soapy water into 2½ gallons of oil and emulsify. To this emulsion add the balance of the water (45 gallons), which may be either warm or cold.

Planting: Growers intending to plant in the spring should assemble their trees at once and heel them in on the ground, ready for planting toward the end of August. At that time the ground will begin to get warmer, and the young trees will establish themselves more quickly.

Fruit in storage: This should now be examined once a week. In the past much loss has been occasioned to orchardists because of neglect in this direction. Growers will be well advised to dispose of, as early as possible, apples which are showing signs of shrivelling. Pears should be got rid of before they become too yellow and ripe. *—W. K. Dallas, Orchard Instructor, Christchurch.*

OTAGO.

Pruning should be made the first consideration, as the season is near when spraying will have to be done regardless of all other work if clean crops are to be assured. All cuttings and branches removed by pruning should be burned, especially where powdery mildew was present last season.

Towards the end of this month spraying with red oil for control of red mite, San Jose scale, woolly aphis, &c., should be commenced, at the following strengths: Pip-fruits, 1–8; stone-fruits, 1–12.

B. G. Goodwin, Orchard Instructor, Dunedin.

POULTRY-KEEPING.

F. C. BROWN, Chief Poultry Instructor.

AUGUST marks an important period in the poultry-keeper's year, for it is then that the arduous work of hatching and rearing another season's stock will be in full swing. Indeed, when birds of general-purpose breeds, such as Rocks, Orpingtons, Wyandottes, &c., are to be raised, every effort should be made to have the full complement of chicks in the brooder before the end of August, or early

in September at the latest. In the case of Leghorns, Minorcas, &c., the hatching may be delayed longer, but not later than the end of September or the first week in October. Chickens brought out later than this seldom prove profitable to rear. Therefore if dear eggs are desired in quantity next winter every available egg from the pick of the stock should be put into the incubator or under broody hens with as little delay as possible.

While date of hatching determines to a large extent the quality of the chickens produced, there are other factors that must be considered if the birds are to develop and be really profitable. The first essential in this connection is to see that the parent birds are maintained in a healthy thriving condition, and are fed and managed in such a way that the eggs produced will contain the desired strength of germ, so that when the chickens are hatched they will be constitutionally strong from the outset and easy to rear.

It will usually be found that better fertility and stronger chicks will be obtained when the breeding-birds are provided with a whole-grain ration at all times, and this fed in deep litter so as to compel them to scratch for it and secure a maximum of exercise. The ration should be plain and consist of a mixture of grains, such as wheat, oats, maize, &c. Rich foods, such as meat, should be sparingly supplied, as forcing for eggs in the breeding-pen usually means the production of delicate chickens that are difficult to rear. Indeed, where a good range is available, meat, milk, &c., should be eliminated from the ration.

See that the male birds are maintained in good condition. They should be frequently handled, and if their weight is less than it should be they should be replaced, or else be given a good meal by themselves at midday. Sometimes a male bird is so attentive to the hens that he allows them to eat up the bulk of the food and becomes half-starved himself, in which case it is impossible to get good results.

ARTIFICIAL INCUBATION.

Hatching chickens by means of incubators is an important work in connection with the poultry plant, but is one of the most difficult matters to guide the novice in by means of printed advice. There are so many different styles of machines, and such considerable variation in the methods of providing the necessary temperature, ventilation, and moisture, that it is impossible to lay down any general instructions that will suit all machines alike.

The best advice to the novice is that before starting he should carefully study the instructions sent out by the maker regarding the working of the particular incubator he proposes to use. True, there are some machines on the market that are little short of death-traps, and even though the instructions accompanying them may be followed to the letter the results are mostly disappointing. It is not the purpose of this note to advocate any one particular system or make of incubator over another, except to say that the novice would be well advised to purchase makes of incubators that have proved their value to our successful poultrymen rather than be led into buying a cheap inferior article on a trade advertisement alone.

BROODING.

Success in raising chickens where artificial means are employed depends largely on the observance of the many little details connected with this important work. The first essential is to prevent chicks from becoming chilled. It is safe to say that, no matter whether it be with a heated or a fireless brooder, more chickens die from chill and its evil effects than from practically all other causes. From this it is not to be inferred that the provision of insufficient warmth is the chief cause of chill -quite the reverse ; overheating in the brooder-box is far more responsible for trouble in this respect. It stands to reason that if the chickens become overheated by night they will be particularly susceptible to chill immediately they leave the brooder in the morning. It is only the person with an observant eye that can really steer safely between the dangers of overheating on the one hand and underheating on the other. Of course, chickens may become chilled from causes other than that of an incorrect temperature in the brooder. It is often due to removing them too soon from the incubator, or to giving too much liberty the first few days. Chickens are most susceptible to chill during the first week, and up to this age they require special care and attention. They should be confined in the brooder for the first three days, and then given only a small area to exercise in until they are well accustomed to their new surroundings.

On no account should the provision of good ventilation in the brooder-box be neglected. Fresh air with the desired warmth is undoubtedly the keynote of successful brooder-management. The brooder should be made in such a way

that the chicks can secure the degree of heat that instinct demands, and at the same time be given an opportunity to breathe pure air. In this respect the novice cannot do better than study nature's methods. There it will be seen that the mother hen's endeavour is to keep the chickens under her wings and by imparting her body-heat to make them warm and comfortable, while at the same time they are given an opportunity to breathe fresh air. She also carries out the hardening-off process by degrees. At first only a few minutes are allowed for feed and exercise, after which she calls them under her body for the purpose of warming them. As they grow older, and providing the weather is favourable, the time given to exercise is extended, but on no account does she neglect to give them a warm-up when required. One of the secrets of rearing chickens in brooders is, indeed, to take a set of instructions from the old hen and follow these to the letter, remembering at all times that she has passed the experimental stage in rearing chickens.

Do not be tempted to overcrowd the chickens. This weak policy is bad enough in any branch of the plant, but it is especially disastrous with the young tender stock. Always remember that one hundred chickens well reared will be more profitable than double the number indifferently cared for.

Whether it be with chickens in the brooder or under the natural mother, be sure and protect them from rats. One rat will sometimes destroy hundreds of chicks in one night, merely for the sake of killing.

Leg-weakness.—If the chickens are going weak in the legs and developing a wobbling walk it indicates that they are huddling at night and require more warmth. The trouble is often intensified by the lack of sufficient bedding on the floor, especially when the floor is very smooth—the constant slipping on the smooth surface during the huddling effort having the effect of spreading and weakening the delicate legs. On the first sign of this condition being observed additional warmth should be applied, by way of extra flame in a heated brooder, and extra covering in the case of a fireless system.

The aim should be to make the chickens comfortable, so that they will spread out over the floor of the brooder. Of course, once chickens have acquired the habit of crowding in corners as a result of being chilled, it is often difficult to break them from it, quite apart from any additional heat that may be supplied. In such case, and in order to prevent leg-weakness and other troubles, it is a good plan to first cover the floor of the brooder with a thin layer of chaff—say, ½ in. On this place a piece of single sacking the full size of the brooder-box, and cover this with chaff to a depth of about 1 in. This will not only provide a comfortable bed for the chicks and induce them to spread out, but it will also greatly assist in preventing the chickens from slipping, with its consequent bad effect on their legs.

Exercise.—For young chickens to do their best it is essential that they have plenty of exercise. In this connection some people make the mistake of placing the food in troughs at all times, which gives the chicks no opp rtunity to scratch for their food as nature intended. For the first few days it is well to feed the chicks on shallow trays or something similar, but after this a good portion should be fed in a manner that will induce them to scratch and keep busy. With this end in view the brooder-runs should be covered to a depth of about 2 in. with straw-chaff in which the ground grains, seed, &c., are scattered. It is instinctive for a healthy chicken to scratch and keep busy, and if it is not given the opportunity to do so trouble may sooner or later be expected. Never use oaten chaff for scratching-material, especially when the chicks are young, as they are apt to eat the oats, with the result that the husks become a hard mass in the gizzard and the chicken soon dies of starvation. Chickens often die from eating the joint of the grain-stalk in the chaff and other fibrous material. If a supply of fine sharp gravel-grit is always available to the chicks right from the start it will go a long way towards preventing trouble in this respect.

FEEDING CHICKS.

What to feed chicks on is largely a question of local conditions, as there are scores of different mixtures that will give equal results. There are now some good mixtures of prepared chick-foods on the market, and where only a small number of chickens are to be reared the best brands of these foods will fulfil all requirements so far as a grain meal is concerned. Of course, green food is always an important article of a chicken's diet, and should be supplied daily after the third day. It should consist of succulent material, such as finely cut grass, lettuce, water-cress, &c.

VITICULTURE.

J. C. WOODFIN, Vine and Wine Instructor.

THE VINEHOUSE.

THE tops of the vine-rods should be kept down until the buds on the lower part of the rods have broken. To promote this the vinery should be closed at night and part of the day, the top ventilator being opened for an hour or two at midday.

The method of attaching the rods to the wires with binder-twine or suchlike material is neither advisable nor economical. Such ties form suitable breeding-places for mealy bugs and other insects, and have to be replaced every year. A better and more convenient way of suspending the rods is to cut some fencing-wire into short lengths, bending them to form hooks of a suitable size to pass the rods through. These hooks should be fixed to the wires so that they will become permanent fittings, and the vines can then be hooked up into position and taken down later with a minimum of trouble and expense.

Young vines can still be planted with success, providing the buds have not yet burst into leaf or are only just bursting. A great deal of the failure in growing young vines in borders where vines have already been grown is due to their being planted in the old soil. The usual result of this practice is that the young vine dies, or, if it lives, makes very poor growth. In planting in an old border a hole should be dug out large enough for the roots to be spread out to their full length with a few inches to spare, and should be about 6 in. deep. The roots should then be shaken free of earth and carefully disentangled. They should then be spread out evenly over the bottom of the excavation and covered with about 2 in. of leaf-mould or fine earth, topping this latter with some good soil from an old pasture, if available, and pressing it down firmly. In the case of grafted vines the union should be an inch or two above the level of the soil so that the scion cannot throw out roots, which it would do if embedded in the earth. If the border is moist at the time of planting, little or no additional water will be required, but the roots must not be allowed to become dry.

The young rod can now be pruned back to two buds, and when the new growth has been led into the house through the hole previously occupied by the old rod care should be taken to let it have as much light and sunshine as possible in order to ensure a strong healthy growth.

CELLAR AND VINEYARD.

The cold dry weather generally prevailing at this time of the year should be taken advantage of for racking old wines and for bottling those sufficiently matured in the wood. In the case of ordinary wines, if absolutely clear and bright, they can be bottled without further preparation. If not quite clear, filtering will generally produce the desired effect.

Fine wines intended for keeping should be fined at least once before bottling; this will hasten the ageing, defecation, and ripening. The materials generally used for this purpose are isinglass, ¼ oz. to ½ oz. per 100 gallons, for white wines; the white of fresh eggs, four to eight per 100 gallons, for red wines; and gelatine, 1 oz. to 1½ oz. per 100 gallons, for either. Spanish clay is also used for fining sweet wines, ½ lb. to 1 lb. being used for this purpose. The amount of finings to be used depends on the degree of cloudiness and the special nature of the wine. The exact amount to be used can be ascertained by experimenting with different amounts of finings on small quantities of wine.

The finings should be dissolved in a little water, and then diluted with wine and stirred into the cask. The tannins and acids of the wine coagulate the albuminous matters contained therein, forming a network which sinks to the bottom of the cask, dragging down all the floating solid matter of the wine.

Some astringent red wines contain so much tannin that the amount withdrawn in the process of clarification effects an improvement to the quality of the wine. If tannin is not present in the wine in sufficient quantity a little must be added in the form of tannic acid before the finings are used. In white wines which have not been fermented on the skins there is very little or no tannin; an addition of ½ oz. to 1 oz. of tannic acid per 100 gallons is necessary to form the desired combination with the gelatinous matter of the finings. The exact amount of

tannic acid required can also be ascertained by experiment on small quantities of wines in white glass bottles, where the effect of the finings can be easily observed.

Pruning should be continued in the vineyard, as previously advised, and the cuttings either burned in a travelling incinerator and the ashes spread over the surface of the vineyard, or carried away and burned. Cuttings for grafting and future planting should be stratified in nearly-dry sand and under cover, preferably in a cellar. Cuttings so treated will strike better than if planted directly they are cut.

THE APIARY.

G. V. WESTBROOKE, Apiary Instructor.

EARLY SPRING WORK.

When the weather is suitable during the coming month (August) the apiarist should make his first examination of the hives, in order to ascertain their requirements for the coming season. Care should be taken, however, to avoid leaving the hives open more than is absolutely necessary, so as to obviate the danger of robbing. Choose a nice warm day when the bees appear to be busy. If during the examination the bees show any signs of robbing it would be better to close up the hive and leave the bees alone for a week or two.

The first care is to see if the hive is "Queen right." If there are eggs or young brood in the centre combs it may be assumed that all is well with the queen. In colonies with ample stores there will, as a rule, be small patches of brood in the centre of one or more of the combs by this time. Where such cannot be found mark the hive for examination a week or so later, as in some cases, more particularly where the queen is old, she may not have yet commenced to lay, and it is therefore not safe to assume that the hive is queenless the first time. Where a hive is found to be queenless it is best to unite it to a strong colony.

It is next essential to see that the bees have sufficient stores to last them through the spring. Do not forget that they consume large quantities of honey when brood-rearing, and except in specially favoured districts they cannot, as a rule, gather sufficient in the early spring to meet their requirements. They must therefore commence this period with a surplus in the hive, and if the combs are empty it will be necessary to start feeding. In apiaries that are absolutely free from disease it would be advisable at this time to equalize the stores by removing a frame or two of honey from those hives that have ample and giving it to those which are short.

While examining the hives glance over the combs of brood to see if foul-brood is showing. If any hive is found to be affected with this disease close it up immediately, and mark it for treatment as soon as possible.

As regards preparations for the spring flow, much depends on the season. In the warmer parts of the North Island the bees will be gathering freely from the manuka. In such districts it will be advisable to have everything ready for supering and swarm-prevention much earlier than is necessary in the colder parts. In all districts, however, it is good policy to have hives ready and frames made up and wired before the busy time arrives. Where the beekeeper intends to produce section honey he should see that the sections are folded up in readiness. In preparing sections it is not necessary to have thin super foundation, the ordinary foundation will answer very well if only a small strip is used—½ in. is ample. In fact, many prefer to use this, as it is found that the heavier foundation is less liable to drop out than the very thin super kind.

REQUEENING.

While it is yet too early to attempt requeening, except in the far North, the beekeeper who intends to introduce new queens into his colonies should order these without delay, as by so doing he will obtain the queens earlier. Those who require early queens are advised to send to the Department's queen-rearing apiary at Tauranga. When ordering state whether tested or untested queens are required, also the month in which they desire to be supplied. When ordering queens the necessary cost should be forwarded, otherwise the order cannot be fulfilled.

THE GARDEN.

W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

ASPARAGUS: New beds should be planted just as the young plants are beginning to grow. The plants are very tenacious of life and do not easily die. The roots, however, are fleshy, and as they are liable to some amount of injury in lifting, decay in damaged roots will follow if growth in the plant is long delayed. The loss of such roots enfeebles the plant. Unless such injured roots are two or more years old, and consequently thick and fleshy, they will not die if growth begins soon after planting. One-year-old plants are best, as the roots, not having spread far, suffer very little when lifted. The roots of older plants will have spread more and cannot be lifted without injury, and consequently the advantage of the larger crowns with more numerous buds in the older plant is more than lost—it becomes a disadvantage as compared with a younger plant. The plan of planting in beds with the plants only a few inches apart has been generally abandoned. The modern plan is to plant in rows on the flat, and not on raised beds. The plants are set at varying distances by different growers, partly ruled by the extent of the plantation. A distance of 30 in. each way between the plants is sufficient for small growers, but for market areas the distance should be greater, so as to allow the use of a plough between the rows. Beds of the old style that have had the top soil stripped off and a layer of manure placed on the bed may now be put in order. Rake off any coarse straw that may be left and return the soil.

Summer rhubarb: To ensure good returns the clumps should be lifted about every three years. The older parts of the clumps become worn and throw but poor stalks. The custom with market-gardeners, or many of them, at the present time is to lift the clumps in December after having taken the first crop. The clumps are chopped up, the best crowns transplanted, and these are left to grow the remainder of the season without being robbed of stalks. They are then in a condition to crop well the following spring. For making a beginning, crowns should be procured now and planted in good soil at a distance of about 3 ft. apart. Stable manure appears to be a necessity in rhubarb-culture; nothing else gives such good results. For established beds the best time and method of application is as a mulch about midsummer. The spring crop, which is the only crop that brings good prices, can only be obtained when there has been a good summer and autumn crop left to die down on the plants. A mulch of manure applied at the time stated helps this crop. Where a new start is made by planting crowns in spring the soil may have a fair amount of stable manure worked into it. No produce should be taken during the first season; if it is the crop for the following spring will be poor. In private gardens the autumn crop is frequently taken. Where this is done it results in the spring crop being so poor as to be useless. The plants are, in fact, converted into autumn croppers, a time when the crop has little value.

Winter rhubarb: These are evergreen varieties, and continue to grow the whole year round. The beds require renewing after about the third year, as they become worn and poor, or even die out if left longer. A start may be made by planting crowns or from seed. If the former, plant during the next month or so. The middle of September is early enough to sow seed. After the start, increase or renewal is best done by raising seedlings, as these grow more luxuriantly than do divisions of old plants. There is a great variation in types of this rhubarb, some giving much finer stalks and more of them than other types. Seed is freely produced, and should be saved from the most promising plants. By this means a bed of the most productive type can be established.

Potatoes: The time to plant is in many places ruled by frosts. Where these are severe it is, of course, useless to plant until their period is considered to be past. In other places late frosts are not usual, but sometimes occur. It is wise to risk this, and if frost does occur it will probably not be severe, but may be hard enough to burn the foliage. If possible, a quantity of wood-ashes should be kept in a dry place, and if the foliage is dusted over with them before the sun reaches it the dry ashes will absorb the rime and prevent damage. I have personally proved this to be effective. In frost-free places planting will be general; indeed, many will have crops well advanced by now. Sprouted sets should be planted wherever it is possible.

Onions: In the more forward places the seed should be in before now, while in nearly all other places it should be sown within the next two or three weeks. The earlier the seed can be sown the better, as it enables a good growth to be

made before the soil becomes dry. It is, however, useless to sow unless the soil is in a good working state and likely to remain so. This largely depends on the character of the soil, and more particularly its condition as regards drainage. Where drainage is not good the soil is liable to become waterlogged after heavy rain, and it would be useless to sow if this occurred. Autumn-sown onions should now be transplanted, this being done before the plants become tall. Lift the plants with a fork, so as not to injure the roots. Plant them as they are, shortening neither the roots nor the tops, as this would delay the start of growth. The shallower they can be planted the better; very little more than the roots should be covered. The best way to plant is to draw a very shallow drill, lay the butt of the plant on one bank of the drill with the roots spread on the bottom (the plant lying flat on the ground, or nearly so), and fill in the drill, treading the soil fairly firm. In three or four days the plants will stand upright, proof that the roots are already taking hold of the soil.

Tomatoes: There is nothing gained by planting before the soil becomes warm; on the contrary, loss is far more probable. The plants cannot make steady progress unless the soil remains warm. A late frost may kill the plants, or a spell of cold weather cripple many of them. In most parts the first week in November is early enough to plant, and this is the case even in the warmer districts where late frosts are general. From eight to ten weeks are required to raise the plants; therefore in most places the last week in August is the best time to sow the seeds.

Plant and sow cabbage, cauliflower, and lettuce. Sow a small breadth with an early short-horn carrot. Sow also turnips, turnip-rooted red beet, and radish. If early parsnips are required sow a turnip-rooted variety, but in general these are not wanted till late autumn or early winter. The best time to sow for such crops, as well as for the main crop of carrots and red beet, is the first week in November.

Herbs.

Parsley requires to be sown every year. After the first start the best plan is to let a plant or two stand to ripen its seed. The seeds may then be harvested and sown, or they may be allowed to fall, when an abundance of young plants will spring up and may be transplanted. Thyme, savoury, and marjoram become woody and of little value if left to grow as they like. The plants should all be cut over when in flower, this causing the production of young and succulent shoots. At least every second year the clumps should be lifted, broken up, and the younger parts replanted. Sage does not require cutting over, but frequent renewal of the plants is necessary, either by dividing or by raising new plants from cuttings, which root easily in a greenhouse or frame in spring if taken before they become soft by renewed growth.

Wheat and Oats Threshings.—Returns of actual threshings received to 20th June by the Government Statistician from millowners showed that until then 6,342,809 bushels of wheat and 3,992,942 bushels of oats had been threshed out. The average yields per acre in cases where particulars of areas were furnished (covering 98 per cent. of total threshings) worked out at 32·75 bushels for wheat and 37·18 bushels for oats.

Address required.—The Department's Chemist has received a letter from a Mr. Robert Muir, who forwarded a sample of limestone for examination. If the sender, who omitted his address, will write to the Chemist, G.P.O. Box 40, Wellington, a report on the sample will be forwarded.

Breaches of Fertilizers Act.—At Dunedin, on 1st July, Messrs. Dalgety and Co. (Limited) were charged on two informations by the Department of Agriculture with giving invoice certificates at variance with the true facts (to the prejudice of the purchaser) in connection with certain fertilizers. The defendants pleaded guilty, representing that an error had been made in the registrations. Counsel for the prosecution stated that it seemed to the Department to be a case of carelessness, and carelessness of a serious nature. On each charge the defendants were fined £2, with costs.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

STORING WOOL.

R. W., Cave :—

Could you give me any information about storing wool? I have some stacked in the wool-shed, and would like to know if it will keep in good condition without being scoured.

The Wool Instructor :—

Wool will keep in good condition for years, provided that it is dry when pressed, and is stored in a dry place. Both of these conditions are essential, as wool naturally absorbs moisture. The best storing-place is one with a wooden flooring which is about 2 ft. from the ground, the result being that there is a draught between the floor and the ground, which keeps both thoroughly dry. Bales must have the caps sewn on properly, and proper attention paid to the corners.

RAGWORT IN HAY.

"SUBSCRIBER," Pirongia :—

Can you inform me if hay containing a considerable quantity of ragwort would be injurious if fed to horses? The hay was cut when the ragwort was in the flowering-stage.

The Live-stock Division :—

Ragwort, when fed in quantities to horses and other stock, is injurious. It causes a hardening of the liver, followed in turn by indigestion, which in time may prove fatal. Animals do not eat this plant readily, and in all probability, when fed as you describe, the hay would be eaten and the ragwort left untouched. It would be advisable as a preventive measure, however, to pick the ragwort out as far as practicable and destroy it. This would help to prevent the ragwort from spreading, by means of the seed, to other parts of the farm.

FERTILIZERS FOR FRUIT-TREES AND THE FLOWER-GARDEN.

"PUHI," Rangiora :—

Will you kindly state the best kind of artificial fertilizers for gooseberries, cherries, apples, and peaches, also for the general run of the flower-garden?

The Horticulture Division :—

This question is more complex than it may at first appear to be—so much depends on the present condition of the soil, what it contains, and what is taken out. The chief requirements of most plants and trees are lime, phosphoric acid, potash, and nitrogen. Humus is essential, and if not present in fair amount should be supplemented by growing green crops (preferably legumes) and ploughing them in. This has special reference to fruit-trees. Lime is required for several reasons, and unless the soil is well supplied with it agricultural lime—1 to 2 tons per acre—should be applied. A good fertilizer for fruit-trees is superphosphate, 2 lb. to 4 lb. per tree according to size; sulphate of potash, ½ lb. to 1 lb.; and nitrate of soda, ½ lb. to 1 lb.; the latter to be applied just as trees begin to grow, and the others during August. Sulphate of ammonia may be

used in place of nitrate of soda; it should be applied during August. Nitrate of soda is preferable if the trees are not making fair growth, being quicker in action than sulphate of ammonia. The gooseberry is the one fruit-bush that gives best results only when stable manure is given. For general use in flower-gardens basic slag is recommended, at the rate of 4 oz. per square yard. A little blood-and-bone should be applied to roses, and bonedust to carnations.

LARGE-LEAVED LUCERNE.

F. G. H., Napier :—

I am desirous of establishing a few acres of lucerne, and would like to obtain a large-leaved variety which I have seen in some plots. Can you tell me the name of the large-leaved variety, and where good seed of such may be obtained?

The Fields Instruction Branch :—

So far as we are aware there is no variety of lucerne in which large leaves are constant. In most of the varieties certain plants will be found which have larger leaves than others, and there are probably as many, if not more, of these in the Marlborough variety than in any other. It appears to be more a condition of growth than variety. The more vigorous growths of the season produce a great many large leaves, but as the season advances and the growth is stunted the leaves become smaller. Attempts at selection do not appear, so far, to have produced a constant large-leaved variety.

LICK FOR BONE-CHEWING COWS.

"DAIRY-FARMER," Wanganui :—

Could you kindly inform me of the constituents of a lick suitable for cows addicted to chewing bones and sticks. I understand that there is such a lick, containing, among other ingredients, bone-meal, and should like to use it pending results from the phosphatic top-dressing of pasture.

The Live-stock Division :—

Pending results from top-dressing, we would recommend that you give each animal daily in its feed the following mixture: Dried sulphate of iron, 1 teaspoonful; common salt, 2 tablespoonfuls; finely ground bone-meal, 1 lb. The latter ingredient, we understand, may be obtained from most merchants or dealers at 27s. or 28s. per hundredweight.

SCALDING A PIG-CARCASE.

"LEARNER," Morrinsville :—

Could you tell me the correct temperature for water in which to scald a pig, and how long the latter should be left in the water to obtain the best results?

The Instructor in Swine Husbandry :—

When the pig is dead and the blood has stopped flowing the pig should be scalded without further delay. There is usually more danger of having the water too hot than too cold. Unless one is an expert, a thermometer should be used to determine the temperature of the water. At the time the pig is being scalded the temperature of the water should be between 150° and 175° F. If it is below 150° too much time is required, while above 175° there is too much danger of setting the hair. Between these temperatures from forty to eighty seconds will be required to scald properly. While in the water the pig should be kept constantly moving to prevent cooling the skin. It is advisable to try the hair from time to time. If the hair comes off easily from the flank the pig is ready for the scudding-table.

Planting of Lemon-trees: Correction.—In line 7 of page 343 of last month's *Journal*, the word "prevents" should read "ensures."

WOOL INDUSTRY REGULATIONS.

FOLLOWING is the text of the Wool Industry Regulations relating to the fixing of minimum prices for wool, control of the wool industry, and prohibition of the export of wool except under prescribed conditions. The regulations were gazetted on 23rd June, and came into force on the next day.

REGULATIONS.

1. These regulations may be cited as the Board of Trade (Wool Industry) Regulations, 1921.

2. In these regulations "Minister" means the Minister of Agriculture.

3. The Minister may appoint a Committee, to be known as the New Zealand Wool Committee (hereinafter referred to as "the Wool Committee"), consisting of two representatives of wool-brokers, two representatives of wool-growers, one Government representative (who shall be Chairman), and such other persons as he may from time to time decide to hold office during his pleasure. At any meeting of such Committee three shall form a quorum. All communications intended for this Committee shall be addressed to the Chairman, New Zealand Wool Committee, P.O. Box 374, Wellington.

4. The Board of Trade may, on the recommendation of the Wool Committee, and with the approval of the Minister, by resolution fix minimum prices for the various kinds and grades of wool; and by notice in the *Gazette* may, with the like recommendation and approval, fix minimum average prices for all or any kinds or grades of wool; and may, on like recommendation and with like approval, in like manner as aforesaid, from time to time alter and amend such prices.

5. It shall not be lawful for any person to sell, or agree or offer to sell, whether by auction or otherwise, any wool at prices less than the relative minimum prices or average minimum prices fixed for the time being in accordance with clause 4 hereof.

6. No person shall sell or agree to sell any wool otherwise than by public auction, unless he shall prior to such sale or agreement to sell have ascertained from the Wool Committee or a person holding a permit under clause 9 hereof the minimum price fixed for the wool proposed to be sold, and all references in these regulations to minimum price shall with respect to that particular wool be references to the price so ascertained.

7. No person shall purchase or agree to purchase otherwise than by public auction any wool at prices less than the minimum prices ascertained in accordance with clause 6 hereof for the particular wool proposed to be purchased. The production by the purchaser to the Wool Committee of a statement in writing signed by the seller or his authorized agent that the prices proposed to be given and accepted are not less than the minimum prices so fixed shall relieve the purchaser from any liability to penalties under these regulations.

8. With the approval of the Minister the Wool Committee may from time to time determine the maximum aggregate quantities of wool that may be offered for sale by private treaty and or by public auction in any period, and may with respect to any specified sale by private treaty or by public auction fix the maximum quantity of wool that may be offered. Any person offering by private treaty or at any auction sale wool in excess of the maximum quantity so specified shall be guilty of an offence against these regulations, and shall be liable accordingly.

9. It shall not be lawful for any person holding a license under the Auctioneers Act to offer wool for sale by public auction, nor for any person to sell wool on commission otherwise than by auction, except subject to the following conditions, viz.: That he shall have obtained a permit issued by the Wool Committee on behalf of the Board of Trade, and shall have deposited with the Wool Committee an undertaking (in such form and subject to such guarantee as the Wool Committee may require) that he will faithfully adhere to such directions as the Wool Committee may give him in writing from time to time as to the maximum quantities of wool that he may offer at any specified auction sale or for sale by private treaty.

10. It shall not be lawful for any person to export wool from New Zealand unless and until he shall have deposited with the Collector of Customs at the port of shipment (*a*) a certificate signed by the Chairman of the Wool Committee or by a person holding a permit under clause 9 hereof that such wool has been

purchased at prices not less than the relative minimum prices fixed at the date of such purchase in accordance with clause 4 hereof, or (*b*) evidence that he has deposited with the Wool Committee an undertaking (in such form and subject to such guarantee as the Wool Committee may require) that he will not sell any wool exported by him, or offer it for sale, or permit it to be sold or offered for sale, in any country at prices less than the relative minimum prices fixed for the time being in accordance with clause 4 hereof, with the addition to such prices of the actual and reasonable amount of freight, insurance, and other costs incurred in placing wool at the point at which delivery in respect to such wool is given or is proposed to be given.

11. Nothing in these regulations shall apply to any sale of wool in New Zealand by private treaty of a quantity not exceeding 800 lb. in weight, save that two or more sales made between the same parties at or substantially at the same time shall be deemed to be one sale for the purpose of this clause.

The Board of Trade, on the recommendation of the New Zealand Wool Committee and with the approval of the Minister of Agriculture, has fixed the following minimum average prices for wool: For all wool grown in New Zealand of 56's quality and under, a minimum average price of 5d. per pound; for over 56's quality, a minimum average price of 9d. per pound.

The Minister of Agriculture has appointed the New Zealand Wool Committee as follows: Messrs. O. J. Hawken, M.P., Hawera, and L. A. Rutherford, Woodgrove (representatives of wool-growers); W. S. Bennett and A. E. Mabin, Wellington (representatives of woolbrokers); and T. R. Lees, Controller, Department of Imperial Government Supplies, Wellington (Government representative).

CLASSIFICATION OF WHEAT FOR 1921–22 GUARANTEE.

In connection with the notice gazetted on 9th June, regarding guaranteed prices for wheat for the season 1921–22, the following classification has been decided upon: "Tuscan" includes all varieties of Tuscan, also Talavera, Dreadnought, Red Marvel, Federation, Yandalla King, John Brown, McCallum's, Bordier, Sensation, and Victor; also all varieties not classed as Hunters or Pearl herein. "Hunters" includes all varieties of Hunters, also Webb's Challenge, Webb's Standup White, Velvetear, and Redchaff. "Pearl" includes Pearl, Velvet, and Bobs.

SAMPLES AND SPECIMENS.

The Department's Chemist desires to notify that considerable trouble is caused through senders of samples and specimens omitting to place their names on the parcels. In many cases it has been found impossible to identify the samples of soil, limestone, &c., with the senders' letters. This leads to disappointment and annoyance to both sender and receiver. The name of the sender should be legibly placed on each package, and if there are more samples than one a number should be attached to each.

REGISTRATIONS UNDER THE FERTILIZERS ACT.

Every person who sells fertilizers is reminded that under the provision of section 3, (1) and (2), of the Fertilizers Act, 1908, he is required to register every year, on or before 1st July, with the Director-General, Department of Agriculture, his name and address, and deposit particulars of every brand of artificial fertilizer sold by him. It is necessary for any such vendor who has not registered to do so at once in order to avoid incurring a penalty for breach of the Act.